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ERRATA.

Page 30 line 39 for "*Anabus*" read "*Anabas*"
,, 44 3 lines from end for "*Wohlfartia*" read "*Wohlfahrtia*"
,, 122 line 32 for "SPENSER" read "SPENCER"
,, 128 lines 16 & 40 for "(vii)" read "(vi)"
,, 133 transfer last line to bottom of page 136
,, 161 line 1 for "SÉGUY (W.)" read "SÉGUY (E.)"
,, 183 line 39 for "Rodenwalt" read "Rodenwaldt"

IMPERIAL BUREAU OF ENTOMOLOGY

REVIEW
OF
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SERIES B.

VOL. XVIII.] [1930.

[KARIBOV (N.).] **Карибов (Н.). An Apparatus for the forcible Feeding of Mosquitos.** [*In Georgian.*]—*Nachr. trop. Med.*, i, no. 1, pp. 73–74, 1 fig. Tiflis, November 1928. (With Summaries in Russian and German, pp. 108 & 114.)

The apparatus consists of a glass tube with a capillary end. A piston, which is removed to insert the mosquito, moves in the tube, and by carefully pushing it, the mosquito is driven down the tube until its proboscis is in the capillary end and it cannot move. The capillary end of the tube is then placed into a drop of liquid, which rises up it and envelops the proboscis of the mosquito. In this way it may be caused to engorge on any liquid, the process only requiring a short time.

HUFF (C. G.). **Ovulation Requirements of *Culex pipiens* Linn.**—*Biol. Bull.*, lvi, no. 5, pp. 347–350, 4 refs. Woods Hole, Mass., May 1929.

As a result of experiments, it was found that oviposition in *Culex pipiens*, L., occurred at intervals of 4–13 days after meals of various substances other than blood, and in one case a female laid viable eggs within 18 hours of emergence without having taken food of any kind, proving that under optimum conditions the species is capable of breeding in the absence of many foods formerly considered essential to oviposition. Adults from larvae kept in a rich solution of haemoglobin produced viable eggs after feeding on milk or soaked raisins, although adults from larvae reared in the normal manner were not capable of producing eggs on a diet of either of these substances.

WILLIAMS (L. L.). **Current Malaria Studies, with special Reference to Control Measures.**—*Pub. Hlth. Reps.*, xliv, no. 33, pp. 2001–2004. Washington, D.C., 16th August 1929.

In the United States malaria has always been most severe in rural areas, but control work, owing to its cost, has been chiefly carried out in urban districts. The author discusses economical measures that he considers would give control in rural areas if generally

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practised. These include the addition of small amounts of plasmochin [*R.A.E.*, B, xvii, 246] to the " chill tonics " that are commonly taken in the southern United States, to prevent the infection of the mosquito; the screening of all farm tenants' shacks, methods having been devised for doing this economically under the organisation of county authorities; and the prevention of breeding of *Anopheles quadrimaculatus*, Say, by the economical use of Paris green as a larvicide [*R.A.E.*, B, xvii, 170]. The impounding of large quantities of water for hydro-electric purposes causes the expenditure of large sums (estimated in one case at £400,000) on clearing land before filling. It is suggested that if such reservoirs were filled without clearing, the brush and trees would die in 6–10 years' time, and the prevention of breeding during these years could be carried out with Paris green applied by aeroplane at an annual cost that is less than the interest on the capital expended in clearing.

HOFFMANN (C. C.). **Los mosquitos *Anopheles*, transmisores del paludismo en el Valle de México.** [*Anopheles* Mosquitos, Vectors of Malaria in the Valley of Mexico.]—*Bol. Dept. Salub.*, 1929, pt. 1, pp. 11–23, 2 figs., 12 refs. Mexico, 1929.

Endemic malaria in the valley in which Mexico City is situated has increased of recent years. The region under consideration lies at an altitude above 7,000 ft. Benign tertian predominates, but some cases of quartan and malignant tertian occur. The vectors are *Anopheles pseudopunctipennis*, Theo., and *A. quadrimaculatus*, Say, which has only recently been recorded from this area. *A. pseudopunctipennis* breeds in clean, clear water, preferably in the presence of *Spirogyra* and other algae. With the advent of the cold season in October and the end of the rains, the number of breeding-places decreases and the frosts destroy the algae, the resultant chemical and microbiological changes in the water appearing to inhibit larval development. Where such changes do not take place, either through the situation of the breeding-place or the effect of frosts being counteracted by currents from springs, breeding continues through the winter, subject to a hibernation during the coldest 8 or 9 weeks or less, during which time adult males appear to be entirely absent. The author was able to observe only one generation of *A. quadrimaculatus* (possibly not the first of the year), which appeared in April. This mosquito does not require such clean or clear water as *A. pseudopunctipennis* and prefers still water. Notes are given on the various districts in which these Anophelines have been observed in this valley. Draining, the clearing of aquatic plants, and dusting with Paris green (in preference to oiling) are the measures recommended.

NAUCK (E. G.) & PICADO T (C.). **Fischfang und Wurmabtreibung durch " Latex."** [" Latex " in Fishing and as a Vermifuge.]—*Arch. Schiffs- u. Tropenhyg.*, xxxiii, no. 10, pp. 536–542, 2 figs. Leipzig, October 1929.

The latex of various Euphorbiaceae is used in Costa Rica as a fish-poison, the plants being crushed and thrown in the rivers. In experiments with *Pedilanthus* sp. (one of the plants employed), it was found that larvae of *Chironomus* were killed in 14 hours, but those of *Culex* were still alive after 48.

Sella (M.). **Gambusie e verde di Parigi nella lotta antimalarica a Rovigno (Relazione per il 1928) e cenni sulla lotta in Istria.** [*Gambusia* and Paris Green in anti-malarial Work at Rovigno (Report for 1928) and Notes on the Campaign in Istria.]—*Riv. Malariologia*, viii, no. 4, pp. 357–392, 4 figs. Rome, 1929. (With Summaries in Italian, p. 476, French, p. 477, English, p. 478, German, p. 479.)

For the control of mosquitos in 1928, as in previous years [*R.A.E.*, B, xvi, 149], *Gambusia* was used alone in some districts, though in one Paris green was also employed. The efficiency of *Gambusia* was clearly demonstrated. Notes are given on malaria in Istria in recent years, with a list of publications dealing with the disease in that area and remarks on the future development of anti-malarial work.

Missiroli (A.). **Sui microsporidi parassiti dell'***Anopheles maculipennis*. [On the parasitic Microsporidia of *A. maculipennis*.]—*Riv. Malariologia*, viii, no. 4, pp. 393–400, 2 pls., 5 refs. Rome, 1929. (With Summaries in Italian, p. 476, French, p. 477, English, p. 479, German, p. 480.)

Descriptions are given of *Thelohania grassi*, sp. n., infesting the eggs of *Anopheles maculipennis*, Mg., in Italy and of another Microsporidian, very similar to *T. legeri*, found in the fat-body.

[Simić (Ch.).] **Симић (Ч.). Peut-on protéger Skoplje de paludisme par la lutte antilarvaire avec le vert de Paris?** [*In Serbian.*]—*Glasnik Tzentr. Khig. Zavoda*, iv (vii), no. 1–3, pp. 22–37, 5 figs. Belgrade, 1929. (With a Summary in French.)

A detailed account is given of the anti-malarial work carried out in Skoplje (southern Serbia) in March–October 1928. The geographical position of the town and the conditions favouring the incidence of malaria there are discussed. Larvae of *Anopheles bifurcatus*, L., *A. maculipennis*, Mg., and *A. superpictus*, Grassi, were found in pools of stagnant water in the centre and outskirts of the town, in irrigation ditches, and in parts of the river Vardar where the stream was slow and the banks marshy. The adults of *A. bifurcatus*, which hibernates in the larval stage, emerge at the end of March or beginning of April; they are much less abundant than the other two species, and of little importance in relation to malaria. *A. maculipennis* hibernates in the adult stage and oviposits in the second half of March, the first generation being especially abundant in the first half of June; a decrease in its numbers takes place simultaneously with the drying up of collections of water. *A. superpictus*, which also hibernates in the adult stage, is the most numerous of the three Anophelines and usually occurs from June onwards, being particularly abundant at the beginning of September. It oviposits in the slow-flowing parts of the Vardar.

All the breeding-places of Anophelines in the town and for a distance of about 2 miles from it were treated with Paris green at various periods. This resulted in a considerable reduction in the number of mosquitos observed and of fresh cases of malaria as compared with those occurring in the previous year. The author points out that

drainage is impossible under local conditions and oiling would be much more expensive than Paris green, as the breeding-places would have to be cleared of the reeds, etc., with which they are covered.

KHAN (Bhupendra Mohan). **Records of Anophelines from the Bengal Dooars.**—*Ind. Med. Gaz.*, lxiv, no. 9, p. 496. Calcutta, September 1929.

In addition to the Anophelines already recorded [*R.A.E.*, B, xvi, 99, 122], *Anopheles jeyporiensis*, James, has been taken for the first time in the Bengal Duars.

Control of Endemic Diseases in the Netherlands Indies (edited by the Netherlands Indies Med. & Sanit. Service).—Imp. 8vo, 77 pp., 16 pls., 4 diag., 8 maps. Weltevreden, 1929.

This series of papers includes (pp. 15–32) a review of the measures adopted against malaria in the Dutch East Indies.

HAMLYN-HARRIS (R.). **The Relative Value of Larval Destructors and the Part they play in Mosquito Control in Queensland.**—*Proc. R. Soc. Queensland*, xli, no. 3, pp. 23–38, 8 pls., 35 refs. Brisbane, 1929.

The various natural enemies of mosquito larvae in Queensland, including predatory insects, *Hydra*, *Vorticella*, and fresh-water snails, are reviewed. Particular reference is made to larvivorous fish, several species being discussed, of which some of the most valuable are *Craterocephalus fluviatilis* and *Melanotaenia migrans* in fresh water and *Pseudomugil signifer* in brackish and salt water.

SEYDEL (C.). **Contribution à l'étude des moustiques du Congo belge. Quelques moustiques de Katanga.**—*Rev. Zool. Bot. afr.*, xviii, fasc. 1, pp. 28–31, 1 ref.; pp. 70–71. Tervueren, 14th August 1929.

Lists are given of 25 species of mosquitos collected in the Kivu district and the volcanic region of the Virunga, including six Anophelines, *viz.*, *Anopheles transvaalensis*, Cart., *A. mauritianus*, Grp., *A. pharoensis*, Theo., *A. gambiae*, Giles, *A. christyi*, N. & C., and *A. funestus*, Giles; and of 14 species collected in Katanga, including *A. gambiae*, *A. funestus*, *A. wellcomei*, Theo., *A. marshalli*, Theo., *A. pharoensis*, *A. argenteolobatus*, Gough, *A. mauritianus*, and *A. mauritianus* var. *ziemanni*, Grünb.

ADLER (S.), THEODOR (O.) & PARROT (L.). **Phlébotomes du Congo belge.**

PARROT (L.). **Sur un autre phlébotome nouveau du Congo belge, *Phlebotomus ghesquierei* n. sp.**—*Rev. Zool. Bot. afr.*, xviii, fasc. 1, pp. 72–89, 13 figs., 5 refs.; pp. 90–91, 1 fig. Tervueren, 14th August 1929.

Descriptions are given of both sexes of the following sandflies collected in the Belgian Congo: *Phlebotomus africanus*, Newst.,

P. simillimus, Newst., *P. ingrami*, Newst., *P. schwetzi*, sp. n., *P. schoutedeni*, sp. n., and *P. collarti*, sp. n. *P. ghesquierei*, sp. n., is described from a single female from Boma.

SCHWETZ (J.). **Quelques observations sur les phlébotomes de Stanleyville.**—*Rev. Zool. Bot. afr.*, xviii, fasc. 1, pp. 133–146, 5 refs. Tervueren, 14th August 1929.

Though observations showed that sandflies (*Phlebotomus*) are not numerous in Stanleyville, they occur there in human habitations, showing a preference for damp and cool conditions. A series of experiments indicated that *Phlebotomus schwetzi*, A., T. & P., may feed on man as well as on cold-blooded animals, whereas *P. africanus* Newst., and *P. schoutedeni*, A., T. & P., appear to feed exclusively on the latter. Human leishmaniasis has not yet been recorded in the Belgian Congo.

[PAVLOVSKIĬ (E. N.) & others.] **Павловский (Е. Н.) и друг. Die tierischen Parasiten und einige parasitäre Krankheiten des Menschen in Tadzhikistan.** [Animal Parasites and some parasitic Diseases of Man in Tadzhikistan.]—Super Roy. 8vo, iv+208 pp., 16 pls., 48 figs. Leningrad, Zool. Mus. Acad. Sci., 1929. Price, *Rb.* 4 *kop.* 50. (In Russian with Summaries in German.)

This is a collection of papers by various authors giving the results of observations in the Tadzhikistan Republic (Central Asia) in 1924–28.

In "The Control of Mosquitos in the former Eastern Bokhara (Tadzhikistan) in 1924–27" (pp. 13–27), A. A. Makar'in states that practically the whole population in the valleys suffers from malaria, conditions favourable to the breeding of Anophelines including the proximity of rice-fields to villages and the neglected state of irrigation ditches and artificial reservoirs of water. The anti-malarial work, a detailed account of which is given, consisted chiefly of draining marshes, cleaning ditches and reservoirs, and dusting with Paris green or oiling. It resulted in a considerable reduction in the number of mosquitos and of primary malaria cases.

I. I. Masaĭtis, in "The Anti-malarial Work in the Town of Kulyab" (pp. 28–40), gives an account of the campaign carried out in 1926–27, which included drainage of the marshes surrounding the town and oiling or dusting with Paris green. Paris green mixed with road dust (2 : 100) killed the Anopheline larvae in 40–60 minutes and only cost half as much as oil. Care is, however, necessary in handling the poison, and dusting is difficult on windy days. All the three forms of malaria occur in Kulyab, but the campaign resulted in a very marked reduction in the number of cases. *Anopheles superpictus*, Grassi, was the most numerous Anopheline, the first adults appearing at the end of April. Next in abundance were *A. sacharovi*, Favr (*elutus*, Edw.), and *A. maculipennis*, Mg. (*claviger*, auct.), which appeared at the end of April and beginning of May, but were very scarce in the summer months, though they increased again after mid-August. *A. bifurcatus*, L., occurred in April–May and September–October. *A. hyrcanus*, Pall., and *A. hyrcanus* var. *pseudopictus*, Grassi, appeared at the end of the summer. *A. pulcherrimus*, Theo., was observed from the second half of the summer till late in the autumn in a village at a distance of over 10 miles from the town. *A. superpictus* and *A. sacharovi* hibernated in both the adult and larval stages.

In a paper by N. I. Latuishev, entitled "A Contribution to the Biology of *Anopheles superpictus* Grassi in Tadzhikistan" (pp. 41–59), *A. hyrcanus* var. *mesopotamiae*, Chr., is added to the Anophelines recorded in that country in the preceding paper, and the approximate distribution of the various species in Central Asia is briefly discussed. *A. superpictus* is the predominant species in Tadzhikistan in districts where springs are present. When ovipositing in rice-fields, the females always prefer those irrigated with water from springs and not from the melting snow in the mountains. The larvae fail to develop in parts of a stream that are far enough away from its source for the chemical composition of the spring water to become changed. The adults are especially abundant from mid-July to mid-October, and the larvae that sometimes occur as early as March and April have probably overwintered, the new generation appearing at the end of June only. The adults prefer inhabited houses to stables and cattle sheds, and, unlike *A. hyrcanus*, which bites chiefly in the open, attack man indoors. They may fly for distances of over $1\frac{1}{4}$ miles and rise to a height of over 100 ft. In one instance they were numerous in caves inhabited by hundreds of bats, which seems to disprove the popular opinion that bats destroy mosquitos. They usually hibernate in the open and are not found in houses from November to June, but a few that remain without hibernating completely sometimes transmit malaria during the winter. The number of eggs laid by a female at one time is usually about 120, and under natural conditions the life-cycle from egg to adult averages 16 days. Field and laboratory observations showed that the larvae can survive without water in damp soil, so that they are not destroyed by periodical drainage of rice-fields for a short time only (2–3 days).

Though *A. superpictus* plays an important part in the transmission of malaria, the author does not agree with the general opinion that it is the chief vector of malignant tertian; in certain districts in Tadzhikistan this form of the disease was less frequent in years when *A. superpictus* was prevalent than when other species were more numerous. *A. hyrcanus* and *A. bifurcatus* do not enter houses, but *A. maculipennis* and *A. sacharovi* are important vectors of the disease. *A. pulcherrimus* was closely connected with malaria in Tashkent, but in Tadzhikistan no cases have been recorded from places where it was abundant. For the control of *A. superpictus* the shallow edges of streams should be treated with oil or Paris green.

P. P. Perfil'ev, in "A Contribution to the Classification and Distribution of *Phlebotomus* in Uzbekistan" (pp. 70–83), divides the genus, according to the male genitalia, into four groups, of which the typical species are *P. papatasii*, Scop., *P. sergenti*, Parr., *P. minutus*, Rond., and *P. perniciosus*, Newst. [which is considered by Sinton and others to be a variety of *P. major*, Ann. (*R.A.E.*, B, xvii, 30)]. Little is known of the biology of these sandflies, and the larvae were not found in nature, although they were easily bred in the laboratory. A list is given of the species that have been observed in Tadzhikistan and Uzbekistan, with notes on their distribution. *P. papatasii* is the most numerous, occurring chiefly in inhabited houses shaded from bright light and sheltered from strong wind. Epidemics of sandfly fever are of frequent occurrence in districts infested by it, beginning in May and reaching their peak in the first half of July. Other species in order of their abundance are *P. sergenti*, *P. sergenti* var. *alexandri*, Sinton, *P. li*, Popov, two unidentified species of the *minutus* group,

P. minutus var. *sogdianus*, Parr., and *P. chinensis*, Newst., which was rare. *P. sergenti* and *P. minutus* var. *sogdianus* were usually associated with animal shelters, though the latter also occurred in houses.

In a paper on "The Larvae of Oestrids as Parasites of the Eyes of Man" (pp. 60–69), E. N. Pavlovskiĭ describes three cases of ocular myiasis that occurred in different districts of Tadzhikistan and were due to *Cephalomyia* (*Oestrus*) *ovis*, L., and *Rhinoestrus purpureus*, Br. The bionomics of these Oestrids is briefly reviewed from the literature, and the characters differentiating the first instar larvae are discussed in detail. Most of the recorded cases of ocular myiasis are stated to be due to *R. purpureus*, though it is probable that *C. ovis* is responsible for a greater number than has been attributed to it, owing to the two species being confused.

In "Ticks of the Genus *Ornithodorus* in Connection with the Problem of the Tick-borne Relapsing Fever in general and in Central Asia in particular" (pp. 84–122), E. N. Pavlovskiĭ gives an extensive review of the literature on relapsing fever, the various spirochaetes concerned, and the transmission of the Central-Asiatic form of the disease by *Ornithodorus*. Both sexes of *O. papillipes*, Bir., and *O. lahorensis*, Neum., which are very common in Central Asia, are described in detail, and an account is given of their distribution in Uzbekistan, Turkmenistan and Tadzhikistan. *O. papillipes* is found at any time of the year in cracks in the mud walls of animal shelters and human dwellings, but very rarely on the host, this being probably due to the fact that it engorges in 20–30 minutes. Nymphs of *O. lahorensis*, on the contrary, were found on camels, sheep, dogs and other animals, chiefly in February, March and April; the adults occurred in the walls of buildings in the spring and summer. A list of the Palaearctic species of *Ornithodorus* is given; other species found in Central Asia are *O. talaje*, Guér., and *O. kholodkovskyi*, Pavlovskiĭ (MS.). From a study of the literature, the author concludes that the only definitely established vector of relapsing fever in Central Asia is *O. papillipes*, which transmits the spirochaetes to animals and man, transmission being effected only through the saliva [*R.A.E.*, B, xvi, 110; xvii, 226, 227].

I. I. Masaĭtis, in "A Contribution to the Study of Tick-borne Relapsing Fever in Kulyab (Tadzhikistan)" (pp. 123–127), gives an account of observations on the disease in 1925–28, including a discussion of its symptoms and the character of the spirochaetes causing it; primary cases were most numerous in April, May and June. The vector was *O. papillipes*, which attacked man and animals in the daytime as well as at night, and when isolated in small boxes filled with earth, lived 5–6 months without food and moulted.

"A Contribution to the Question of the Distribution of *Ornithodorus* and of the Reservoirs of Spirochaetosis in Central Asia" (pp. 128–130), by I. A. Moskvin, contains a brief account of an expedition to various parts of Central Asia in the summer of 1928. Ticks were abundant in the mud walls and floors of sheds for domestic animals, and to a less extent in human dwellings, to which they were probably carried from the sheds by dogs. *O. lahorensis* was prevalent in Ferghana, but in other regions *O. papillipes* occurred alone. These ticks were not found on the numerous domestic animals examined, though they have often been recorded as crawling on sheep and cows in winter, but without feeding on them. No spirochaetes were found in blood from domestic animals, bats or small rodents.

A paper by E. N. Pavlovskiĭ, " On Elephantiasis Arabum in Tadzhikistan " (pp. 131–142), deals with three cases of the disease, two of which were observed by him in 1928 in Tadzhikistan, and one in 1927 in Pyatigorsk (Caucasus). No microfilariae were found in the blood of any of the patients, the first two cases being due to bacterial infection, and the third being the result of serious illness from which the patient had suffered in early childhood. The aetiology of elephantiasis is discussed and the work of various authors on *Filaria* is reviewed in detail, with a list of the mosquitos that have been recorded as vectors of *F. bancrofti*.

Two papers by E. N. Pavlovskiĭ and A. K. Stein, entitled " The poisonous Beetle, *Paederus albipilis*, Solsky, from the Hissar Region and its Effect on the Skin of Man " (pp. 186–189), and " Experimental Investigation on the Effect of the Blister Beetles, *Epicauta* and *Mylabris*, on the Skin of Man " (pp. 190–196), deal with the forms of dermatitis experimentally produced by various beetles found in the Hissar Valley of Tadzhikistan.

In discussing " Present Problems of local Parasite Work in Tadzhikistan " (pp. 199–208), E. N. Pavlovskiĭ outlines a plan for the organisation of investigations, giving a list of recent Russian literature on parasites of man, with detailed instructions for the collection and preparation of specimens of blood-sucking Arthropods and other parasites.

Bauer (J. H.) & Hudson (N. P.). **The Incubation Period of Yellow Fever in the Mosquito.**— *J. Exptl. Med.*, xlviii, pp. 147–153, 7 refs. New York, 1928.

The experiments described were undertaken with a view to determining the length of the " extrinsic " incubation period, or interval between the initial infecting feed and the time at which the mosquito, *Aëdes argenteus*, Poir. (*aegypti*, auct.), is capable of inducing yellow fever infection in vertebrates. Uniform numbers of mosquitos were made to bite normal monkeys (*Macacus rhesus*) at intervals of two days and upwards after the infecting feed, each lot after feeding being ground up and injected into susceptible monkeys. These injections demonstrated that the virus of yellow fever exists in infectious form in *A. argenteus* throughout the entire period of extrinsic incubation. The virus was first transmitted through the bite of the mosquitos on the ninth day.

de Beaurepaire Aragão (H.) & da Costa Lima (A.). **On the Contamination of Haemolymph in Mosquitoes infected by the Yellow-fever Virus.**—*Suppl. Mem. Inst. Oswaldo Cruz*, no. 10, pp. 251–255, 1 pl., 1 ref. Rio de Janeiro, 31st August 1929. (Also in Portuguese.)

The authors refer to Hindle's experiment [*R.A.E.*, B, xvii, 110] in which yellow fever was not transmitted by inoculation of the legs, containing coelomic fluid, of infected mosquitos [*Aëdes argenteus*, Poir.], and record the successful transmission of the disease by inoculation of legs of mosquitos contaminated with excreta [*cf.* xvii, 213, 237] a few moments before inoculation. To find whether the haemolymph of infected mosquitos contains the yellow fever virus, the fluid was withdrawn directly from the pericardial chamber, the technique of

which process is described. A monkey (*Macacus rhesus*) inoculated with this fluid died of yellow fever, as did another inoculated with an emulsion of the bodies of the same mosquitos.

SERGENT (Et.) & PARROT (L.). **Sur l'existence de** *Phlebotomus papatasi* **(Scop.) et de** *Phlebotomus minutus* **Rondani, en rase campagne.**—*Bull. Soc. Path. exot.*, xxii, no. 7, p. 544, 1 ref. Paris, 1929.

Although Palaearctic sandflies, particularly *Phlebotomus papatasii*, Scop., are usually regarded as domestic insects, rarely found except in the vicinity of human habitations, the authors took both *P. papatasii* and *P. minutus*, Rond., from the burrows of small wild rodents in the banks of a river bed some distance north of Biskra in May 1929. Both species were numerous in all the burrows examined, despite the fact that most of them were 2 miles from the nearest dwelling. They were also found in small natural excavations and in the galleries of *Merops apiaster*. No larvae or pupae were found, and it therefore seems probable that the sandflies use the burrows merely as diurnal resting places. All those captured were fasting with the exception of three females taken from a burrow that also contained toads (*Bufo viridis*) and *Ornithodorus* [*marocanus*, Velu] [*cf. R.A.E.*, B, xvii, 238], but a microscopical examination of the blood in one of them showed it to be of mammalian origin.

PERFILIEV (P. P.). **Sur les phlébotomes du Turkestan et sur** *Phlebotomus sergenti* **var.** *alexandri* **Sinton.**—*Bull. Soc. Path. exot.*, xxii, no. 7, pp. 545–549, 7 figs., 3 refs. Paris, 1929.

During a recent mission to Turkestan the following species of sandflies were collected: *Phlebotomus sergenti*, Parrot, *P. chinensis*, Newst. (*major* var. *longiductus*, Parrot), *P. papatasii*, Scop., and a variety that appeared to be *P. sergenti* var. *alexandri*, Sinton, of which the male is described and compared with the typical form.

DE BOISSEZON (P.). **Remarques sur les conditions de la reproduction chez** *Culex pipiens* **L. pendant la période hivernale.**—*Bull. Soc. Path. exot.*, xxii, no. 7, pp. 549–553, 3 refs. Paris, 1929.

Observations and experiments on the hibernating and egg-laying habits of *Culex pipiens*, L., made in the south of France during the winter of 1928–29, showed that during hibernation these mosquitos can resume activity (apparently under the influence of heat), take a blood meal, and oviposit. Under suitable conditions of temperature and nourishment, the resulting larvae develop normally and give rise to adults. The absorption of haemoglobin is not necessary for oviposition, and albumin (human serum) and fruit juice (slices of apple) are sufficient to induce maturation of the eggs, a diet of apple alone being all that is required if the temperature of the environment is suitable. Under favourable conditions of temperature pairing may take place during hibernation, both in nature and in experimental cages.

Sebenzov (B. M.) & Adova (A. N.). **La réaction actuelle du milieu dans l'écologie d'***Anopheles maculipennis* **Mg.**—*Bull. Soc. Path. exot.*, xxii, no. 7, pp. 584–606, 3 figs., 10 refs. Paris, 1929.

During 1928 further experiments were undertaken in Russia on the influence of biological and biocoenotic factors on the distribution of the larvae of *Anopheles maculipennis*, Mg., in turf-pit waters [*cf. R.A.E.*, B, xvii, 65, 240]. In these experiments the contents of the artificial reservoirs, which previously consisted of solutions in distilled water of salts physiologically necessary to life with a subsequent addition of biological matter, were replaced by natural turf-pit waters in which the factors under study had been chemically modified. As in the previous experiments, two control reservoirs contained natural and distilled waters. In each receptacle, excepting the one containing distilled water, two slabs of peat were placed with a flora typical of their waters. After a discussion on the food of the larvae, the authors conclude that there is almost no natural water that does not contain nourishment, even when microscopic examination reveals a scarcity of organisms. For this reason they consider that the chemical composition of the waters is of greater importance than the nutritional factors. They conclude that the hydrogen-ion concentration is the most important factor in the distribution of larvae of *A. maculipennis* in turf-pit waters and that for this species a pH of 5 is the biological limit below which first stage larvae die. The limit for the second stage larvae has not been determined, but for third stage larvae it is probably about 4·3. There are also indications that a pH of more than 9·7 is quite unsuitable for the development of eggs and larvae. It is suggested that the campaign against these Anophelines would be more likely to be successful if the pH of the waters were reduced to 4 artificially (*e.g.*, by sulphuric acid).

Carpenter (G. D. H.). **Sleeping Sickness.**—*Kenya & E. Afr. Med. J.*, vi, no. 5, pp. 131–148. Nairobi, August 1929.

An account is given of the history and spread of sleeping sickness, with particular reference to Uganda. The clinical, pathological and epidemiological aspects of the disease are briefly dealt with. The status of the trypanosomes and their insect vectors is discussed, and the present measures for controlling the disease are outlined.

Zavattari (E.). **I tripanosomi africani parasiti dell'uomo. Nuovi fatti e nuove ipotesi sulla loro individualità.** [African Trypanosome Parasites of Man. New Facts and Hypotheses on their Identity.] —*Natura*, xx, no. 3, pp. 73–91, 6 figs. Milan, 1929.

The morphological and biological characters of *Trypanosoma gambiense*, transmitted by *Glossina palpalis*, R.-D., *T. rhodesiense*, transmitted by *G. morsitans*, Westw., and *G. swynnertoni*, Aust., and *T. brucei*, transmitted by *G. morsitans*, *G. pallidipes*, Aust., *G. tachinoides*, Westw., and *G. brevipalpis*, Newst., are discussed, with the course of their development in the fly. *T. brucei* and *T. rhodesiense* are extremely virulent to laboratory and domestic animals, *T. gambiense* being less so. Whether man is susceptible to *T. brucei* is still a matter of doubt. The distribution of the sleeping sickness trypanosomes, *T. gambiense* and *T. rhodesiense*, corresponds with that of their respective vectors, while *T. brucei* occurs throughout central tropical Africa.

THEODOR (O.). **Ueber ein nicht pathogenes Trypanosoma aus der Ziege und seine Uebertragung durch** *Lipoptena caprina* **Aust.** [On the Occurrence of a non-pathogenic Trypanosome in the Goat and its Transmission by *L. caprina*.]—*Z. Parasitenk.*, i, no. 2, pp. 283–330, 6 pls., 15 figs., 28 refs. Berlin, 10th August 1928.

A preliminary account of this study has already been noticed [*R.A.E.*, B, xvi, 164]. Whether the trypanosome described from goats in Palestine is identical with *Trypanosoma melophagium* remains to be determined. Unless heavy infestation occurs, *Lipoptena caprina*, Aust., does not appear to do serious injury to goats, which it infests chiefly on the underside of the body. Young flies cannot live more than two days without food. Flies are found singly throughout the year, but they are most numerous from April to August. Three weeks after pairing they deposit the first pupae on the ground. The pupal stage averages 30 days at 30° C. [86° F.], and raising the temperature has little effect on its duration.

REGENDANZ (P.). **Die multipule Teilung des** *Trypanosoma criceti*, **seine Entwicklung im Hundefloh und Uebertragungsversuche auf den Hamster.** [The multiple Division of *T. criceti*, its Development in the Dog Flea and Transmission Experiments to the Hamster.] —*Z. Parasitenk.*, ii, no. 1, pp. 44–54, 1 pl., 4 figs., 14 refs. Berlin, 17th June 1929.

Some hamsters (*Cricetus*) were infected with *Trypanosoma criceti* by placing excreta from infected fleas (*Ctenocephalus canis*, Curtis) on their tongues, and others by injections of blood containing the trypanosome.

SMIT (B.). **The Sheep Blow-flies of South Africa.**—*Bull. Dept. Agric. S. Africa*, no. 47, 27 pp., 4 pls., 11 figs. Pretoria, 1929.

Much of the information contained in this somewhat popular account of the life-history, distribution and control of *Chrysomyia chloropyga*, Wied., *C. albiceps*, Wied., and *Lucilia sericata*, Mg., the three blowflies that attack sheep in South Africa, has already been noticed [*R.A.E.*, B, xiv, 73 ; xvii, 153]. Life-history data given as applying to all three species are similar to those noticed in respect of *L. sericata* [xvii, 153]. The eggs of *C. chloropyga* hatch in about the same time as those of *L. sericata*, the feeding stage of the larvae is slightly longer, being 3 days in summer and 3 weeks in spring and autumn, and the pupal stage lasts about a week at mid-summer and 7 weeks in winter. The crawling stage, which occurs between the abandonment of the meat by the larva and pupation, lasts 3 days in summer, so that the minimum period from egg to adult is 13 days. The adults begin to oviposit 9 days after emergence. The life-history of *C. albiceps* resembles that of the two other species, except that in very hot weather the pupal stage may be as short as 4 days, with a total life-cycle of only 10.

In addition to the fly traps already noticed [xiv, 73], various methods of disposing of carcases, including burning, boiling up into meat meal and spraying with arsenical poisons, are discussed. Other methods of carcase disposal described include the use of an open-ended trough made

of two 6-foot pieces of corrugated iron bolted together and bent upwards at the sides so that the edges overhang inwards. The trough is hung with pieces of wire between four fencing poles, with the open ends directly over two paraffin tins having their tops cut away so as to leave a rim ½-in. wide all round inside the tops. The larvae from the masses of eggs laid on carcases thrown, unpoisoned, into the trough crawl away when full grown and fall into the paraffin tins, where they are killed by the application of a little water and paraffin. It is suggested that the larvae may be preserved for poultry food, or be allowed to pupate in cages to produce additional supplies of the parasite, *Mormoniella vitripennis*, Wlk. (*Nasonia brevicornis*, Ashm.).

An improved method of applying poison is the use of a shallow tank, such as a 40 gal. oil drum cut in half, partly filled with poison and with wire netting stretched over it on which the carcases are thrown and attract numbers of flies; many of these feed on the sweetened poison and are killed. The larvae developing from eggs laid on the carcases drop into the poison after feeding. Another method is to throw the carcases into a pit the mouth of which is covered with wire gauze, so that the flies are attracted without being able to reach the carcases and feed on tins of poison placed round the mouth.

Methods of keeping sheep in clean condition to render them unattractive to the flies are discussed. Volatile substances such as petrol, benzene or chloroform are recommended for application to infested sheep for the destruction of the larvae. Oil and disinfectants should be applied to heal the skin, and pine-tar oil, pyridine and creosote will act as temporary repellents.

SENIOR-WHITE (R.). **A new biting Ceratopogonine from India.**—*Arq. Esc. méd.-cirurg. Nova-Gôa*, Sér. A, fasc. vi, reprint 2 pp., 1 pl. Nova Gôa, 1929.

Tersesthes luteigaster, sp. n., which is described from females from Nova Gôa, Portuguese India, attacks man, its bites giving rise to papules that remain for some days. The midges occur on the sea shore and are reported to disappear with the rains.

DINULESCU (G.). **Descriptions de la larve au premier stade du *Gastrophilus inermis* Brauer. La myiase gastrophilienne des joues chez le cheval.**—*Ann. Paras. hum. comp.*, vii, no. 5, pp. 419–429, 3 pls., 7 figs., 10 refs. Paris, 1st September 1929.

During observations on horses in Paris, eggs of *Oestrus* (*Gastrophilus*) *inermis*, Brauer, were rarely found, except on one individual from the north of France. They are laid on the hairs on the cheeks. The larvae burrow into the cheeks and make winding galleries under the skin until they reach the mucous membrane of the mouth, where they remain until the first moult. Descriptions are given of the first instar larva and the lesions caused. Eggs of *O.* (*G.*) *nasalis*, L., and *O.* (*G.*) *intestinalis*, DeG., were found on the same horse, the former affixed to the hairs under the lower jaw and the latter to the internal surface of the carpal region.

NITZULESCU (V.). **Contribution à l'étude des phlébotomes de Roumanie.** —*Ann. Paras. hum. comp.*, vii, no. 5, pp. 430–437, 5 figs., 11 refs. Paris, 1st September 1929. **Sur quelques phlébotomes de Yougoslavie.**—*T.c.*, no. 6, pp. 494–505, 5 figs., 8 refs. 1st November 1929. **Contribution à l'étude des phlébotomes européens.**—*C.R. Soc. Biol.*, cii, no. 26, pp. 161–162, 3 refs. Paris, 18th October 1929.

In the first two papers detailed descriptions are given of a male sandfly captured in a house in Bucarest, and of three males and a number of females from Skoplje, Serbia. The author considers that all these sandflies are *Phlebotomus chinensis*, Newst., which has not previously been recorded from Europe, and he confirms Sinton's view [*R.A.E.*, B, xvii, 30] that *P. major* var. *longiductus*, Parrot, is a synonym of this species. The characters distinguishing it from *P. major* var. *perniciosus*, Newst., which is also recorded from Skoplje, are discussed. In a supplementary note it is stated that many further specimens of *P. chinensis*, both males and females, have been taken at Bucarest. The males from Bucarest agree entirely with the description given by Parrot of specimens from Bokhara [xvii, 17], but differ slightly from the Serbian ones.

The third paper is a preliminary note on the sandflies dealt with in detail in the first two.

TALICE (R. V.). **Sur quelques larves de Trombidinae de l'Uruguay, parasites des animaux.**—*Ann. Paras. hum. comp.*, vii, no. 6, pp. 483–493, 5 figs., 19 refs. Paris, 1st November 1929.

Domestic and wild animals in Uruguay are commonly infested by Trombiculid larvae. Larval mites from the rodent, *Cavia aperea*, and from the lizard, *Teius teyou*, were identified as *Trombicula irritans*, Riley. The method of attachment and feeding of these mites, as studied in preparations made from the ears of *C. aperea*, is described in detail, and the observations of previous authors on this subject are discussed.

CIFERRI (R.). **Sur un** *Grubyella* **parasite de simulidés,** *Grubyella ochoterenai* **n. sp.**—*Ann. Paras. hum. comp.*, vii, no. 6, pp. 511–523, 2 figs., 9 refs. Paris, 1st November 1929.

A fungus, *Grubyella ochoterenai*, sp. n., obtained from dead adults of *Simulium* sp. in Mexico is described. In San Domingo, adults of *Culicoides phlebotomus*, Will., and *Hippelates texanus*, Mall., exposed to infection in a test-tube, were found to be dead with the fungus on them, although it was not certain that they were killed by it. Since some species of *Grubyella* cause ringworm in man, it is possible that Simuliids may carry infection with this disease.

VITZTHUM (H.). **Systematische Betrachtungen zur Frage der Trombidiose.** [Systematic Considerations of the Question of Trombidiosis.]—*Z. Parasitenk.*, ii, no. 2, pp. 223–247, 7 figs., 2 pp. refs. Berlin, 12th October 1929.

The most important and widely distributed harvest-mite in Europe is *Trombicula autumnalis*, Shaw, but other species occur in almost all

parts of the world. The eggs are laid in the ground in such enormous numbers that when the larvae hatch, after about a month, the soil is red with them. From here, and from low-growing plants, they attach themselves to any warm-blooded animal that comes within reach. They live on the body-juices of the host, without ingesting blood, for 2–3 days, and then disappear into the ground, where both the nymphal stage, rather more than a month later, and the adult stage, occur.

The larvae attach themselves to the skin of the host and inject the secretion of the salivary glands through the stylostome, the severity of the reaction varying in different individuals. In New Guinea the natives are immune, while Europeans and Malayans suffer seriously. Moreover, there are districts in which the larvae swarm without causing the typical lesions, in spite of the established fact that there is no difference in their life-history. In the author's opinion there must, therefore, be some micro-organism which exists in certain districts, and not in others, and which is inoculated by the larvae. Such an organism must pass through the eggs, since no food is taken before the larvae become attached to the host. They do not transmit acquired infection, as they do not pass from the original host to another.

GATER (B. A. R.). **Annual Report of the Division of Entomology for the Year 1928.**—*Ann. Rep. Med. Dept. F.M.S. 1928*, pp. 69–74. Kuala Lumpur, 1929.

In view of the possible connection of rats with tropical typhus in the Federated Malay States, the following ectoparasites found on these rodents are recorded: nine species of Trombiculids, of which *Trombicula* (*Schöngastia*) *indica*, Hirst, was the most common; *Laelaps* sp. and *L. echidninus*, Berl.; *Notoedres* sp., in the ears; a Listrophorid; two species of lice, of which *Polyplax* (*Haematopinus*) *spinulosa*, Burm., was the more numerous, and *Xenopsylla cheopis*, Roths. A winged Psocid was found in the fur of some individuals. The two species of *Laelaps* may be ignored as possible vectors of the disease, owing to their apparent aversion from man. In view of the fact that many of the coolies contracting the infection were engaged in pruning oil palms [*Elaeis guineënsis*], a search was made for Arthropods of possible importance in the material handled. An examination of old male flowers revealed the presence of numerous mites, including Trombiculids. It was subsequently learnt that it is only in areas that are being opened up for harvesting that dead flowers are allowed to remain for more than a few months, and as the normal fauna of dead male flowers consists of Lepidopterous larvae, it would appear that the fauna changes as the flowers age; the fact that most of the tropical typhus infections appear to occur among coolies opening up areas for harvest and therefore coming into contact with the old flowers containing mites is suggestive.

A critical examination of Malayan species of Anophelines showed that two, if not three, have been confused under *Anopheles fuliginosus*, Giles, and that two varieties of *A. ludlowi*, Theo., and of *A. maculatus*, Theo., had not been distinguished. Larvae of what is apparently a new variety of *A. umbrosus*, Theo., were found in brackish water along the coast at Pulo Langkawi.

Experiments showed that the length of life of *A. maculatus* varied greatly under different conditions. With a constant relative humidity of 65 per cent. it did not exceed 7 days, whereas with higher humidity

it was prolonged in one case to 40 days and in many instances to nearly a month. When a second blood meal was offered four days after the first, 80 per cent. of the mosquitos refused to feed, though whether this indicates that only a few bite a second time and so infect man with malaria is not known.

Various substances of possible larvicidal value were tested against *A. vagus*, Dön., but so far none has been found to compare with mineral oil in price and efficiency. Of the non-arsenical substances used, sodium silicofluoride killed 96 per cent. of the larvae in 20 hours at a concentration of 1 part in 10,000 of water under laboratory conditions. Calcium arsenate destroyed 80 per cent. under similar conditions in the same time, but Paris green gave 100 per cent. mortality in an hour. Commercial calcium cyanide (Cyanogas) killed all larvae in 1 hr. 40 mins. when used at the rate of 1 part to 20,000, and was effective at lower concentrations, but it cannot be recommended for field use until more is known of its possible toxic effects on other animals and plants. Various commercial dyes were incorporated in the Paris green dust mixture in an attempt to leave visible traces of dusting [*cf. R.A.E.*, B, xvi, 68] at a slightly increased cost, but although one or two showed promise, the results as a whole were disappointing.

Culex fatigans, Wied. (*quinquefasciatus*, Say), *Aëdes* (*Stegomyia*) *albopictus*, Skuse, and *Armigeres obturbans*, Wlk., were found breeding in numbers in many of the sewage disposal installations recently erected in Kuala Lumpur. *C. fatigans* frequents houses, and all three species have been stated to be carriers of dengue in other countries.

The flies that breed in human and animal excreta are briefly discussed. The specific identity of the common housefly of Malaya is doubtful, but it is probably *Musca bakeri*, Patton, which breeds in material with a much greater moisture content than would be suitable for *M. domestica*, L., such as cow-dung.

Papers noticed by Title only.

Kröber (O.). **Ergebnisse einer zoologischen Sammelreise nach Brasilien, insbesondere das Amazonasgebiet, ausgeführt von Dr. H. Zerny. I. Teil. Diptera: Tabanidae.** [Tabanids collected by Dr. H. Zerny in Brazil, particularly the Amazon Region.]—*Ann. naturh. Mus. Wien*, xliii, pp. 243–255, 13 figs. Vienna, 1929.

de Beaurepaire Aragão (H.) & da Costa Lima (A.). **Sur la transmission du virus de la fièvre jaune par les déjections de moustiques** [*Aëdes argenteus*, Poir.] **infectés. Transmission de la fièvre jaune par l'application de fèces de moustiques infectés sur la peau et la muqueuse oculaires intactes. Sur le temps minimum nécessaire aux stégomyies infectées pour excréter des fèces virulentes.**—*C.R. Soc. Biol.*, cii, no. 26, pp. 53–54; no. 29, pp. 477–478, 1 ref., & 478–480. Paris, 18th October & 8th November 1929. [*Cf. R.A.E.*, B, xvii, 213, 237.]

de Beaurepaire Aragão (H.). **Possibilité de l'infection d'***Aëdes aegypti* [*argenteus*, Poir.] **males par le virus de la fièvre jaune. Infection des** *Aëdes aegypti* **males avec les virus de la fièvre jaune. Possibilité de la transmission directe de la fièvre jaune de stégomyie à stégomyie.**—*C.R. Soc. Biol.*, cii, no. 26, pp. 54–56; no. 29, pp. 476, 1 ref., & 474–475. Paris, 18th October & 8th November 1929. [*Cf. R.A.E.*, B, xvii, 237.]

[Orlov (E. I.).] **Орлов (Е. И.). The Yellow Ground Squirrel (*Citellus fulvus* Licht.)** [including a List of Fleas attacking it in the Lower Volga Region]. [*In Russian.*]—*Mater. Fauna Lower Volga Reg.*, pt. iv, pp. 3–112, 5 pls., 95 refs. Saratov, Lab. Study Poison Substances, 1929. (With a Summary in English.)

[Ioff (I. G.).] **Иоффъ (И. Г.). Supplementary Data on the Ecology of Jerboa Fleas** [in the Stalingrad Government]. [*In Russian.*]—*Mater. Fauna Lower Volga Reg.*, pt. iv, pp. 113–121, 2 refs. Saratov, Lab. Study Poison Substances, 1929. (With a Summary in German.)

Apfelbeck (V.). **Neue Culiciden aus Bosnien und Dalmatien.**—*Konowia*, viii, no. 3, pp. 286–292, 7 figs. Vienna, 25th September 1929.

Wagner (J.). **Ueber die nordamerikanische Ceratophylli, welche auf Zieseln und Murmeltieren leben.** [A Revision of the North American Fleas allied to *Ceratophyllus* living on Ground Squirrels (*Citellus*) and Marmots.]—*Konowia*, viii, no. 3, pp. 311–315. Vienna, 25th September 1929.

Bau (A.). **Das Genus *Ornithoica* Rondani (Diptera, Hippoboscidae)** [with a Key to the Species].—*Zbl. Bakt.* (2) lxxix, no. 8–14, pp. 246–248, 2 figs., 3 refs. Jena, 21st October 1929.

[Pavlovskiĭ] Pawlowsky (E. N.) & Stein (A. K.). **Ueber die giftigen Eigenschaften des Käfers *Paederus fuscipes* (Fam. Staphylinidae) auf die Menschenhaut.** [On the poisonous Action of *P. fuscipes* on the Human Skin.]—*Z. Parasitenk.*, i, no. 3, pp. 476–483, 5 refs. Berlin, 27th October 1928.

Moskvin (I. A.). **Ueber die Rolle der Zecke (Ixodoidea) *Ornithodorus papillipes* Bir. (Turkestan) in der Uebertragung des Rückfallfiebers.** [The Part played by the Tick, *O. papillipes*, in the Transmission of Relapsing Fever.]—*Z. Parasitenk.*, ii, no. 1, pp. 73–89, 8 figs., 38 refs. Berlin, 17th June 1929. [*Cf. R.A.E.*, B, xvi, 110.]

Wigglesworth (V. B.). **Digestion in the Tsetse-fly [*Glossina*]: a Study of Structure and Function.**—*Parasitology*, xxi, no. 3, pp. 288–321, 1 pl., 16 figs., 2 pp. refs. Cambridge, 30th September 1929.

Borel (E.) & Labernadie (V. G. F.). **A List of the Species of Mosquitoes collected in the French Settlements in India.**—*Ind. Med. Gaz.*, lxiv, no. 9, pp. 495–496. Calcutta, September 1929.

Hecht (O.). **Die Hautreaktionen auf den Stich von *Anopheles maculipennis* (Diptera, Culicidae).** [The Reactions of the Skin to the Bite of *A. maculipennis*.]—*Anz. Schädlingsk.*, v, no. 10, pp. 117–119, 4 figs. Berlin, 15th October 1929.

Hirst (S.). **On some Australian Species of Trombidiidae.**—*Proc. Zool. Soc. Lond.*, 1928, pt. 4, pp. 1021–1034, 1 pl., 7 figs. London, January 1929.

Hirst (S.). **Additional Notes on Australian Mites of the Family Trombidiidae, with Descriptions of new Forms.**—*Proc. Zool. Soc. Lond.*, 1929, pt. 2, pp. 165–176, 7 figs. London, August 1929.

TURBET (C. R.). **A Note on the Air Sac Mite Disease of Poultry in Suva.**—*Agric. J. Dept. Agric. Fiji*, i (1928), no. 3, p. 27. Suva, 1929.

Serious mortality has occurred among fowls in Fiji as a result of infestation with the air-sac mite, *Cytoleichus* (*Cytodites*) *nudus*, Vizioli. The mite enters the body of the fowl by way of the air passages and lives in the large air spaces of the body, wandering freely on the membranes. It causes irritation, carries the germs of disease and may possibly produce a poison that affects the host. When it occurs in large numbers between the lung and chest-wall, it may cause death from pleurisy or pneumonia. New birds should be chosen from clean stock and should be isolated as a precaution. If a flock is infested, it is probably better to kill off the birds and leave the run untenanted for a time. If the infested birds only are killed, the sanitary conditions should be improved for the surviving birds by whitewashing with a wash containing 5 per cent. carbolic acid, treating the soil with fresh lime or chloride of lime, etc. A dessertspoonful of sulphur mixed in the mash food for each dozen birds is the best known treatment for infestation.

VITZTHUM (H.). **Zoologische Acarusstudien.**—*Z. Parasitenk.*, i, no. 1, pp. 1–23, 18 refs. Berlin, 17th April 1928.

This is a critical summary of present knowledge of mites of the genus *Sarcoptes* (*Acarus*), together with original observations on *S. scabiei*, L. (*A. siro*, L.) on man and some of its subspecies on various animals. Besides the typical *S. scabiei*, the subspecies *canis*, Gerl., to which the author is inclined to give specific rank, is able to develop in the human skin, but none of the other subspecies can do so, nor can they even maintain life for any length of time on man.

DELANOË (P.). **Contribution à l'étude du spirochète marocain, *Sp. hispanicum* var. *marocanum* Ch. Nicolle et Ch. Anderson, 1928.**—*Arch. Inst. Pasteur Tunis*, xviii, no. 2, pp. 133–162, 1 pl., 1 fldg. table, 2 figs., 1 map, 3 refs. Tunis, June 1929.

This is a detailed account of the discovery, in association with pigs, porcupines and foxes, in the Doukkala region of Morocco, of *Ornithodorus marocanus*, Velu, including individuals infected with a spirochaete closely allied to *Spirochaeta hispanica* var. *marocana* of Mansouria [*R.A.E.*, B, xvi, 219; xvii, 168]. A preliminary account has already been noticed [B, xvii, 122]. In this part of Morocco, pigs pasture during the day and shelter at night in rough stone enclosures, and it was in the stone walls and under stones and dead palm leaves on the ground in these enclosures that *O. marocanus* was obtained in numbers.

In connection with the experiments to determine the infectivity of *O. marocanus* associated with pigs, the author states that one batch of 129 ticks that were allowed to feed on guineapigs on 2nd June 1928 had been kept in a tin box since 7th March 1922, without having fed; only three of the 129 refused to feed, but the guineapigs did not become infected.

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In one experiment with adults of *O. marocanus* from a porcupine burrow, each of five individuals was allowed to feed on a different guineapig, two of them developing relapsing fever.

The author considers that the rarity of spirochaetes in *Ornithodorus* associated with pigs, in spite of the proximity in some cases of porcupine burrows in which the ticks are infected, indicates that infection originates from the haunts of wild animals, and also that its carriage from these to the enclosures occupied by pigs does not take place so readily as was thought, since porcupine burrows are common in Morocco. No spirochaetes were found in the blood of two porcupines captured alive in a burrow in which infected ticks were found subsequently.

When investigating the relation of *O. marocanus* to man, the author found numerous ticks in the earthen floors of an Arab dwelling and school, and in the latter he noticed also the faeces of rodents. The inhabitants stated that all their dwellings were infested with these ticks, but that their bites did not cause illness ; a guineapig on which 61 nymphs and 3 adults collected in the village were allowed to feed did not develop infection. The author suggests that the village became infested with *O. marocanus* from pig farms, and he recommends that pigs should be kept as far as possible from human habitations.

A table shows the times at which spirochaetes were present, and their frequency in the blood, during the course of the disease in all the experimentally infected guineapigs. The incubation period ranged from 4 to 9 days, and recovery took place in 29–38 days, the date of recovery being fixed arbitrarily as 10 days after the final disappearance of spirochaetes from the blood. Except in one case, in which a filtrate prepared from macerated ticks was inoculated into the animal, all the guineapigs were infected by allowing the ticks to feed on them.

Nicolle (C.), Anderson (C.) & Hornus (P.). **Etude d'un spirochète du groupe *Sp. hispanicum* S. de Buen, isolé d'un cas de fièvre récurrente marocaine.**—*Arch. Inst. Pasteur Tunis*, xviii, no. 2, pp. 163–187, 6 refs. Tunis, June 1929.

The experiments reported in detail in this paper have been noticed from a preliminary account [*R.A.E.*, B, xvii, 168]. The experimental transmission of *Spirochaeta hispanica* by means of lice [*R.A.E.*, B, xiv, 168, 193] is discussed. It has been suggested that the lice [*Pediculus*] employed, which were obtained from Tunisian natives, were infected with the spirochaete of European relapsing fever [*S. recurrentis*], and that it was with this spirochaete that the experimental monkeys were infected. European relapsing fever is rare in Tunis, and there were no cases when the experiments in question were carried out ; moreover, the course of the disease in the infected monkeys, and many subsequent experiments with the strain obtained from them, prove conclusively the identity of the spirochaete. The authors consider that the partial adaptation of *S. hispanica* to lice is therefore incontestable.

They conclude that all the spirochaetes transmitted by *Ornithodorus marocanus*, Velu, in Morocco, including the strain (or strains) studied by Delanoë [see preceding paper], which may be referred to as *S. hispanica* var. *marocana* of Doukkala, belong to a single group, and that further attempts to differentiate them by means of cross-immunity

or serological tests would be useless [but *cf. R.A.E.*, B, xvii, 226]. The strains so far investigated may be distinguished as *S. hispanica* var. *marocana* of Mansouria, of Bou Znika and of Doukkala.

NICOLLE (C.) & ANDERSON (C.). **Note au sujet des deux précédents mémoires.**—*Arch. Inst. Pasteur Tunis*, xviii, no. 2, pp. 188–198, 3 refs. Tunis, June 1929.

The first part of this paper is a brief summary of the authors' work on Moroccan spirochaetes [*R.A.E.*, B, xvi, 159, 219 ; xvii, 168, etc.]. The second part is a criticism of Delanoë's paper [B, xviii, 17], in which the authors give their reasons for believing that small wild rodents are the chief reservoir of *Spirochaeta hispanica* var. *marocana* in Morocco. The occurrence of a high percentage of infection among individuals of *Ornithodorus marocanus*, Velu, from porcupine burrows is easily accounted for by the presence in the burrows of small rodents, which are found everywhere in Morocco ; it provides no indication that the porcupines themselves are infected, any more than the occurrence of an equally high percentage of infected ticks in fox earths indicates that the foxes are infected. The small rodents in Morocco probably belong to species closely allied to, if not identical with, those of Tunis, all of which are susceptible to the Moroccan spirochaete. Porcupines are not common, even in the Doukkala region, and are probably absent from the coastal district, where human cases have occurred ; moreover, they nearly always live far from human habitations. The rarity of infection in ticks on pig farms as compared with those in burrows merely tends to show that small wild rodents are more important as reservoirs of the spirochaete than domestic ones (rats, etc.). Wild rodents are fewer around habitations, on account of the presence of domestic ones, with which *O. marocanus* comes less in contact. Whether or not the porcupine is susceptible to the spirochaete, it can be of little importance as a reservoir of the disease.

The authors do not consider that man is of any importance as a reservoir of the spirochaete, since human habitations in Morocco are always infested with small rodents, which are the only reservoir needed.

NICOLLE (C.) & ANDERSON (C.). **Les spirochètes récurrents marocains du groupe *hispanicum* ne sont pas séparables en espèces.**—*C.R. Acad. Sci. Fr.*, clxxxix, no. 21, pp. 817–819. Paris, 1929.

In an experiment to test Delanoë's contention that the spirochaetes from ticks [*Ornithodorus marocanus*, Velu] from Mansouria and from porcupine burrows in the Doukkala district belong to a species (*Spirochaeta marocana*) distinguished from *S. hispanica* of Spain and of Bou Znika by the non-recurrent nature of the fever that it produces in man [*R.A.E.*, B, xvii, 226], the Mansouria strain produced a fever with several relapses in a human subject. From this it is concluded that there is no justification for separating this spirochaete and that of Doukkala, which have been shown by Delanoë to be very closely allied, from the other tick-borne spirochaetes of Morocco ; they all belong to the group of *S. hispanica*.

Schulze (P.). **Die heutige Verbreitung einzelner Tierarten im Lichte der erdgeschichtlichen Vergangenheit (besonders der Zecken *Dermacentor reticulatus* auct. und *Hyalomma marginatum* Koch).** [The present Distribution of certain Animal Species in the Light of ancient geographical History (especially the Ticks, *D. reticulatus* and *H. marginatum*).]—*Z. Morph. Oekol. Tiere*, xv, no. 4, pp. 735–754, 6 figs., 2 pp. refs. Berlin, 9th November 1929.

In the course of this paper, the author discusses the status of the genera, *Dermacentor*, *Cynorhaestes* and *Crotonus*, and adopts the view that *Dermacentor* and *Crotonus* should be treated as synonyms of *Cynorhaestes*. He also considers that Fabricius' description of *Acarus reticulatus* applies to a nymph of *Ixodes* and that the species usually recorded as *Dermacentor reticulatus*, F., is that previously described by Sulzer as *Acarus marginatus*.

Pessôa (S. B.) & Corrêa (C.). **Note on the Biology of *Rhyparobia maderae*, Fabr.**—*Rev. Biol. Hyg.*, i, no. 3, pp. 83–86, 1 pl. S. Paulo, 1928. (Also in Portuguese.)

Rhyparobia maderae, F., is a large domestic cockroach common in many localities in S. Paulo. Other cockroaches are rare in houses infested by it. Notes are given on its bionomics as observed in the laboratory. Sweetened milk, bread and biscuits were given as food, but the larvae fed principally on dead cockroaches placed in the cages.

Pessôa (S. B.) & Corrêa (C.). **Sobre a disseminação de cystos de *Giardia intestinalis* (Lambl.) pelas baratas.** [On the Dissemination of Cysts of *G. intestinalis* by Cockroaches.]—*Rev. Biol. Hyg.*, i, no. 1, pp. 90–93, 7 refs. S. Paulo, 1927. (With a Summary in English.)

Experiments at S. Paulo have shown that the cysts of *Giardia intestinalis* may be disseminated by the cockroaches, *Blattella* (*Phyllodromia*) *germanica*, L., *Periplaneta americana*, L., and *Rhyparobia* (*Panchlora*) *maderae*, F., in the larval, nymphal and adult stages. The greatest number of live cysts was found in the excreta 48 hours after ingestion by the cockroaches, and a few could still be found after 7 days. Under experimental conditions dissemination by regurgitation of ingested material was observed.

Pinto (C.). *Ornithocoris toledoi*, **a new Genus and Species of Fowl's Bug.**—*Rev. Biol. Hyg.*, i, no. 2, pp. 17–22. S. Paulo, 1927. (Also in Portuguese.)

A Cimicid, *Ornithocoris toledoi*, gen. et sp. n., is described from fowls in S. Paulo, Brazil.

Prado (A.). **Notas sobre os Anophelineos do estado de São Paulo.**—*Rev. Biol. Hyg.*, i, no. 2, pp. 87–89, 4 refs. S. Paulo, 1927. (With a Summary in English.)

A list is given of the Anophelines found by the author in S. Paulo, with the localities in which they were taken. The species recorded are *Anopheles tarsimaculatus*, Goeldi, *A. argyritarsis*, R.-D., *A. braziliensis*,

Chagas, *A. argyritarsis* var. *alloplia*, Lutz & Peryassú, *A. pseudomaculipes*, Chagas, *A. intermedius*, Chagas, *A. eiseni*, Coq. (*tibiamaculatus*, Neiva), *A. mediopunctatus*, Theo., *A. nigritarsis*, Chagas, and *A. cruzi*, D. & K. A variety of *A. nigritarsis* is described, but not named. *A. cruzi*, a vector of malaria on the coast, was rare.

Gibson (A.) & Twinn (C. R.). **Household Insects and their Control. (With a Chapter on Animal Pests other than Insects.)**—*Bull. Dept. Agric. Canada*, N.S. no. 112 (Ent. Bull. 30), 84 pp., 1 pl., 90 figs. Ottawa, June 1929.

This bulletin gives useful information regarding household insects, including some that attack man or may be associated with disease, with practical recommendations for their control.

Hall (D. G.). **Volck Oil, Special Emulsion Number Two, as an Animal Insecticide.**—*J. Kansas Ent. Soc.*, ii, no. 4, pp. 74–82, 1 ref. McPherson, Kans., October 1929.

Further experiments with volck oil, prepared with a special emulsifier, for the control of external parasites of domestic animals [*R.A.E.*, B, xvii, 25] are described.

Dipping for 10 minutes in a 6 per cent. emulsion gave satisfactory results against *Ctenocephalus* on dogs and cats, but only such fleas as actually come in contact with the oil are apparently affected, and it does not seem to have any repellent effect. Less satisfactory results were obtained with 4 and 5 per cent. emulsions. *Trichodectes canis*, DeG. (*latus*, Nitz.) on a dog was controlled by dipping the animal twice in a 5 per cent. emulsion at an interval of 15 days ; a 7 per cent. emulsion did not kill the eggs of this louse. Similarly, a 6 per cent. emulsion killed all stages except the eggs of *T. equi*, L., on a horse. *Haematopinus suis*, L., on pigs was killed when the animals were dipped in a 6 per cent. emulsion, and a second dipping, 15 days later, gave complete control, but emulsions up to 12 per cent. did not kill the eggs. Spraying was less satisfactory than dipping in the control of *H. suis*, on account of the inaccessibility of the lice in such places as the ears and the deep folds about the legs. Dipping pigs in a 20 per cent. emulsion had no effect in controlling *Sarcoptes suis*, Gerl., and even when undiluted and applied many times, this emulsion proved ineffective against *Demodex canis*, Leydig, on a dog.

Payne (L. F.). **A new Method of controlling Feather Mites.**—*J. Econ. Ent.*, xxii, no. 5, pp. 819–820, 1 ref. Geneva, N.Y., October 1929.

The results secured against *Liponyssus* [*sylviarum*, C. & F.] (feather mite) in Kansas by painting the perches and supports in fowl-houses with 40 per cent. nicotine sulphate confirm those already noticed from Ohio [*R.A.E.*, B, xvii, 163]. Birds that had been severely infested were free from mites on 5th June, their perches having been painted on 3rd, 6th and 9th May about 20 minutes before they were occupied. Since, according to C. R. Cleveland, the eggs hatch in 36–96 hours and the complete life-cycle lasts only 8–12 days, sufficient time was allowed for any live mites to appear, either from the eggs or from crevices in the building. Unlike dips [xiv, 214], nicotine sulphate can be used at any season of the year; it may also be applied from an oil-can along the upper surface of the perches.

Brain (C. K.). **Insect Pests and their Control in South Africa.**—Demy 8vo, xii+468+viii pp., 204 figs. Cape Town, Die Nasionale Pers Beperk, 1929. Price, 25*s*.

This is a comprehensive handbook on the insects, ticks and mites of economic importance in South Africa and the means for their control, considerable attention being given to species that attack man and domestic animals. One section of the volume deals with the diseases transmitted by insects and ticks, with special reference to South Africa, where tick-borne diseases of animals cause serious losses each year, and many thousands of square miles of agricultural land in the north and east cannot be developed satisfactorily owing to the prevalence of malaria, of which *Anopheles gambiae*, Giles, and *A. funestus*, Giles, are the chief carriers.

Nearly half of the numerous illustrations are from original drawings or photographs.

Hase (A.). **Zur pathologisch-parasitologischen und epidemiologisch-hygienischen Bedeutung der Milben, insbesondere der Tyroglyphinae (Käsemilben), sowie über den sogenannten "Milbenkäse." Beiträge zur experimentellen Parasitologie. 3.** [On the pathological-parasitological and epidemiological-hygienic Importance of Mites, especially of Tyroglyphinae (Cheese-mites), together with Notes on the so-called "Mite-Cheese." Contributions to experimental Parasitology. 3.]—*Z. Parasitenk.*, i, no. 4–5, pp. 765–821, 8 figs., 7 pp. refs. Berlin, 26th March 1929.

This paper is a critical review of the literature. Mites are shown to be capable of causing skin diseases and tumours in living animal and vegetable tissue. The part they play in causing allergic diseases is discussed, allergia being defined as a reactivity of certain persons against certain materials (allergens), which include mites, mite-dust and mite faeces. Symptoms of allergic disease caused by mites are usually associated with either the skin or the respiratory system. There is no doubt that, in addition to those that attack the skin directly (*Pediculoides*), those that infest store-houses and dwellings also produce allergic disease. Disorders of the stomach and intestines caused by mites that infest stored products may in some cases be allergic and in others due to general toxic effect. A review of current reports shows that mites in houses and stores are a definite danger to health ; trades particularly exposed to this danger are indicated. An account is also given of the production of mite-cheese, for which mites are deliberately bred artificially, and of the ecology of the Tyroglyphinae.

Backhouse (T. C.). **Sarcoptic Skin Disease in Natives of the Territory of New Guinea.**—*Trans. R. Soc. Trop. Med. Hyg.*, xxiii, no. 2, pp. 173–178, 2 pls., 8 refs. London, 26th August 1929.

A disease known in New Guinea as kas-kas is described, four clinical types being encountered, and it is shown that it is almost certainly caused by *Sarcoptes scabiei*, L., this mite having been found in a considerable number of cases. The disease was mainly found amongst aggregations of natives living under conditions favouring the spread of *Sarcoptes*. The author placed two female mites from a case of the crusted variety on his wrist ; these immediately burrowed and in a

few days produced lesions resembling those of severe infected scabies. Lesions of the crusted cases resemble Norwegian crusted scabies, but examination of the mites from these did not give conclusive evidence that they were *S. scabiei scabiei-crustosae*, Fürst. [*cf. R.A.E.*, B, ix, 148]. The author is of the opinion that the crusted condition is merely an advanced stage, owing to neglect, of the disease caused by *S. scabiei*. Attention is also drawn to the similarity between this disease and that known as craw-craw in Sierra Leone [xii, 190].

Macfie (J. W. S.) & Thompson (J. G.). **A Trypanosome of the Canary (*Serinus canarius* Koch).**—*Trans. R. Soc. Med. Trop. Hyg.*, xxiii, no. 2, pp. 185–191, 1 pl., 3 figs., 4 refs. London, 26th August 1929.

A trypanosome closely resembling *Trypanosoma paddae*, found in the blood of canaries and in the body cavity of mites (*Dermanyssus gallinae*, DeG.) infesting them, is described. Emulsions of mites heavily infected with trypanosomes were administered to healthy birds by intraperitoneal injection or through an oesophageal tube. After a few days trypanosomes were found in the blood of the birds subjected to intraperitoneal injection. In view of the fact that the trypanosomes are present in the body cavity of the mite and not in the diverticula of the gut, it is suggested that they are transmitted by the mites being swallowed by the birds or crushed into their skin. The development of the trypanosomes in the body of the mite is described in detail.

MacGregor (M. E.) & Lee (C. U.). **Preliminary Note on the artificial Feeding of Mosquitoes.**—*Trans. R. Soc. Trop. Med. Hyg.*, xxiii, no. 2, pp. 203–204. London, 26th August 1929.

In attempts to infect *Anopheles maculipennis*, Mg., *Culex pipiens*, L., and *Aëdes argenteus*, Poir., with bird malaria, only a few individuals could be induced to feed on the birds. The mosquitos also refused to feed on citrated human blood. Both males and females, however, fed readily on citrated blood to which a little honey had been added [*cf. R.A.E.*, B, xvii, 237]. The blood mixture ingested was found to be almost entirely confined to the oesophageal diverticula, though when a mosquito feeds by puncturing the skin, the blood passes directly into the stomach. The honey appeared to have no deleterious effect on the red blood corpuscles.

Swellengrebel (N. H.). **On the Influence of the Wind in the Spread of *Anopheles maculipennis*.**—*Amer. J. Hyg.*, x, no. 2, pp. 419–434, 4 maps, 27 refs. Baltimore, Md., September 1929.

For two years anti-mosquito measures were carried out within a two-mile radius of the centre of the town of Medemblik, which is situated on a promontory jutting out into the Zuyder Zee, but the density of *Anopheles maculipennis*, Mg., was not reduced to less than one-third of that outside the treated area, and the possibility of invasion from outside was considered, although it was not understood why the mosquitos should fly two miles in a northerly direction, when food, shelter and breeding-places were immediately available to the south, east or west. Experiments with stained mosquitos indicated that the prevailing wind, which blows from the south, south-west and west,

was a factor in their dispersion. It was concluded that in the absence of a wind sufficiently strong to carry them away, the mosquitos seek the nearest possible feeding places, otherwise they follow the direction of the prevailing wind. In this case it favours their dispersion in a northerly to north-westerly direction, and carries them much further than is necessary in the search for food, to the centre of the controlled area, where they are stopped by a dense human and animal population and a town-like arrangement of the buildings. In localities in this area the daily catches of *A. maculipennis* were almost three times as great on days following a wind that had passed over the untreated breeding-places as on days succeeding a sea wind.

HERTIG (M.) & HUANG (T. F.). **A Rat-flea Survey of Peking.**—*Amer. J. Hyg.*, x, no. 2, pp. 521–525, 2 refs. Baltimore, Md., September 1929.

An account is given of a rat-flea survey of Peking that was carried out from 1st May 1926 to 30th April 1927. *Xenopsylla cheopis*, Roths., and *Ceratophyllus anisus*, Roths., were the only species of flea observed, with the exception of a single specimen of *Ctenocephalus felis*, Bch., *X. cheopis* being by far the most numerous. The seasonal variations in its incidence correspond to those noted in other regions, an increase in numbers beginning with the onset of warm weather in May, continuing during the hot moist summer months, and reaching its maximum in August. The numbers decrease abruptly in October and reach their minimum in the cold and extremely dry winter months. The figures obtained for *C. anisus* are scarcely large enough to be significant, but indicate that it tends to reach its maximum numbers in spring. Investigations at Hsüchowfu, Kiangsu, during 1924 and 1925 indicated that the rat-flea population of that region is similar to that of Peking. Conditions in Peking are compared with those in Shanghai [see next paper] , and although *X. cheopis* has begun to increase in numbers in Peking at the time plague is most likely to be introduced from the ports of South China (April–June), it is thought that its geographical position renders the introduction of the disease into Peking less probable than into Shanghai. Cases derived from Manchuria are always of the pneumonic form and occur in winter, both of which circumstances militate against the establishment of plague in the rat population. Moreover, throughout most of the year climatic conditions, notably the extreme dryness and the cold winter, are unfavourable to the establishment and maintenance of plague.

All rats examined were *Mus rattus*. No evidence of plague infection was found in cases where autopsies were carried out and no rat epizootics are known to have been recorded in Peking. Both species of flea were also found in small numbers on a few of the house mice (*Mus wagneri*) examined.

HICKS (E. P.). **The Relation of Rat-fleas to Plague in Shanghai.**—*J. Hyg.*, xxvi, no. 2, pp. 163–169, 1 chart, 12 refs. Cambridge, July 1927.

The history of plague in Shanghai is briefly discussed, and an account is given of a rat-flea survey undertaken from 1923 to 1926. The fleas obtained were *Ctenocephalus felis*, Bch., *Leptopsylla segnis*, Schönh.

(*Ctenopsylla musculi*, Dug.), *Ceratophyllus fasciatus*, Bosc, and *Xenopsylla cheopis*, Roths. *X. cheopis*, which predominates in the hot moist summer, and *C. fasciatus*, which is most numerous in the cold winter and spring, are both known to carry plague, the former in tropical, the latter in temperate climates. In spite of the fact that climatic conditions are not such as to inhibit its introduction, plague is relatively uncommon, a fact that is probably due in some measure to seasonal differences between Shanghai and the ports where plague is endemic, infection in Hongkong being at its height in April, May and June, whereas it reaches its maximum in Shanghai in November and December. *L. segnis* is of little importance in the epidemiology of plague owing to its reluctance to bite man, and few cases of human plague occur when the flea index of *C. fasciatus* is at its maximum. It is therefore suggested that *X. cheopis* is mainly responsible for the spread of the disease in Shanghai, and the relative freedom from plague is possibly due to the fact that this flea reaches its maximum numbers from August onwards, whereas the infection is most likely to be introduced from China ports, or at least from Hongkong, from April to June. The discrepancy between the number of cases of human and rat plague may possibly be explained by the fact that *C. fasciatus* lives apart from its host, a habit that restricts its power of infecting rats, but to a far greater extent restricts its chances of biting man.

MACKIE (F. P.). **The present Position of the Plague Problem.**—*Trans. 7th Cong. Far East. Ass. Trop. Med. 1927*, ii, pp. 2–21, 7 maps, 7 charts. Calcutta [1929].

A brief outline is given of the present position with regard to plague in various countries throughout the world. Plague is primarily a disease of rodents, and the various small mammals that have recently been shown to constitute reservoirs of infection in India, South Africa, California, northern Asia and southern Russia are discussed. Problems relating to the fleas that transmit the disease are briefly reviewed, and the importance of inoculation with Haffkine's vaccine as a prophylactic measure is pointed out.

NIKANOROFF (S.). **The Plague Problem in the South-east of Russia.**—*Trans. 7th Cong. Far East. Ass. Trop. Med. 1927*, ii, pp. 84–95, 2 charts. Calcutta [1929].

Plague outbreaks in South-east Russia are periodical, the maximum incidences occurring in June and November. There are two distinct foci, each with a different epidemiology. In the more populated areas of the steppe where the ground is hard clay, the ground squirrels (*Citellus* spp.) are the main reservoirs. These rodents are in the open from April until August, and plague epizootics occur among them in May and June. Outbreaks of plague in man closely correspond to these, the possibility of primary infection disappearing when hibernation occurs among the rodents. Old rodents that have hibernated seldom succumb to the epizootic, which usually assumes large proportions when the young become independent. The susceptibility of ground squirrels to plague, which is rather high in summer, decreases about the time of hibernation, when the disease runs a slow and chronic course. It is

highly probable that ground squirrels can hibernate in an infected state and develop acute plague in the spring, when infection is transmitted to their young, which are very susceptible.

In the sandy areas, the principal animals infected with plague are the house mouse (*Mus musculus*) and the sand mouse (*Gerbillus meridianus*), there being no rats in these areas. Plague epizootics among these rodents are always of an acute character and greatly reduce their numbers. The existence of plague in chronic form between epizootics has never been proved, and it seems more probable that a new infection occurs each time. In areas where loose sand intermingles with more or less hard ground, rodents from both steppe and sandy regions come into contact, and as their fleas constantly interchange hosts, plague is readily conveyed from one set of rodents to the other. Although epizootics do not seem to be confined to any season, endemic outbreaks in sandy areas usually occur in autumn. At this time the nomadic tribes settle in their winter huts, which, amidst the bare sand, are the only habitable places for mice. Moreover, in late autumn these tribes collect a wild graminaceous plant which also serves as food for the mice, and, as they are in such close contact with the rodents, if an epizootic occurs infection in man is unavoidable.

An investigation of the fleas of man, rodents and domestic animals in South-east Russia revealed 47 species belonging to 22 genera. It was proved that under laboratory conditions all fleas subjected to experiment were able to transmit plague to healthy animals. Although the distribution of *Ctenophthalmus pollex*, Wagn., seems to correspond to the area where plague-infected ground squirrels occur, no specific " plague flea," such *Xenopsylla cheopis*, Roths., in the tropics, has yet been found.

Laboratory experiments with fleas of ground squirrels showed that at a continuously low temperature infective fleas can starve for more than 12 months, thus conserving the plague bacilli from one epizootic season to another, but the presence of plague bacilli in fleas found in the burrows of rodents was never proved, and infection was not found " preserved " in the fleas in the winter or spring. It therefore seems unlikely that fleas act as reservoirs of the disease.

The anti-plague measures outlined consist chiefly in the discovery of epizootics, educational campaigns to prevent the contact of the local population with the rodents, the destruction of the latter, and the fumigation of their burrows to prevent the infection of rodents immigrating from neighbouring healthy districts. Such work is, however, only possible on a limited scale under favourable conditions.

STRICKLAND (C.). **A Pseudotyphus Epidemic in southern Queensland and its aetiological Bearing upon Cases in India.**—*Trans. 7th Cong. Far East. Ass. Trop. Med. 1927*, ii, pp. 517–539. 21 refs. Calcutta [1929].

An account is given of an epidemic of pseudotyphus that occurred in Queensland [*R.A.E.*, B, xiv, 108]. In view of the prevalence of mice [*Mus musculus*], which might conceivably have been the reservoir, a study was made of their ectoparasites. They do not appear to harbour ticks, and no history of tick bite was recorded for any of the cases. The absence of a primary sore or lymphatic affection, such as is common in tsutsugamushi disease, might be considered as presumptive evidence that the disease under discussion was not carried by mites, but as it

has been reported that subcutaneous (as opposed to intracutaneous) inoculation does not give rise to any local reaction, it is possible that the Australian cases may have been carried by a species of mite with a long proboscis. Five individuals of *Laelaps australiensis*, Hirst, a Gamasid with a comparatively long proboscis, were found on the mice. *Leptopsylla segnis*, Schönh. (*Ctenopsylla musculi*, Dug.), which was common on the mice, is not known to bite man, but may conceivably do so. With regard to parasites of other possible reservoirs, the bush tick, *Ixodes holocyclus*, Neum., which infests many animals, is the common cause of tick paralysis, but the distribution of this disease and pseudotyphus do not correspond, and the tick is not common on the fertile farm lands where the epidemic occurred. The distribution of pseudotyphus and plague is not the same, but one of the common rat fleas, *Ctenophthalmus agyrtes*, Hell., is a country species, and though not concerned in the transmission of plague in towns, might be responsible for an epidemic of a disease in the country. Rats are said to be the reservoir of pseudotyphus in Sumatra [*R.A.E.*, B, xiii, 84], and though the disease appeared to be associated with mice, when there is an increase of mice there is also an increase of rats, which feed on them. A list is given of the mites that have been found on rats. Of these, *Laelaps agilis*, Koch, has been found to attack man in Australia. With regard to other possible reservoirs, the fowl tick, *Argas persicus*, Oken, may be responsible, but it has never been known to attack man in Australia. On the other hand two fowl mites, *Dermanyssus gallinae*, DeG. (*avium*, Dug.) and *Liponyssus bursa*, Berl., commonly attack man [*R.A.E.*, B, xi, 145].

With regard to pseudotyphus in India, a list is given of Indian ticks that attack man ; none of these is normally parasitic on rodents, but some are occasionally found on them. A list is also given of the Indian rodents, indicating briefly their habits and distribution, with a view to discovering a relationship between them and the distribution of pseudotyphus. As in Australia, the distribution of plague does not correspond to that of pseudotyphus, and rat-fleas are therefore not likely to be concerned in the transmission of the latter. As rodents may not prove to be the reservoir, blood-sucking Arthropods attacking other animals are briefly discussed. There is no evidence of direct transmission from man to man by an Arthropod.

WATSON (Sir M.). **The Future of Malaria Control in the Federated Malay States.**—*Trans. 7th Cong. Far East. Ass. Trop. Med. 1927*, ii, pp. 599–608. Calcutta [1929].

The history of the organisation of malaria control in the Federated Malay States is reviewed. A climate favourable for Anopheline breeding and the immigration of a large non-immune population from India and China have rendered malaria control difficult, but the very severity of the disease has necessitated strenuous remedial measures. Much research has been carried out and anti-malaria work thoroughly organised. As a prophylactic, quinine has proved a complete failure, and the author considers that as a treatment for infection no general population would take the drug for a long enough period to prevent relapses. In the future many methods will be used, but mosquito control by such means as jungle clearing, jungle cover, drainage, oiling, etc., is regarded as the most reliable measure. The cost of malaria control varies enormously. The discovery of the harmlessness of certain

jungles and of the value of shade in certain zones has made it possible to control the most virulent malaria in hill country without any expenditure, and in flat country infection can be avoided by selecting sites for houses not less than half a mile from undrained jungle. On the other hand the upkeep of open drainage, and thorough oiling in intensely malarial hill county are very expensive, and the capital cost of subsoil drainage is very high. In spite of this, practical experience has shown that the control of mosquitos and malaria in the Federated Malay States is economically desirable and financially practicable.

GILL (C. A.). **The Theory and Practice of Malaria "Control."**—*Trans. 7th Cong. Far East. Ass. Trop. Med. 1927*, ii, pp. 624–634. Calcutta [1929].

The scientific study of malaria in the Punjab during a period of 14 years has shown that wherever the economic status of the population is low, as a result of waterlogging, excessive salinity of the soil, or long-continued agricultural depression, a high degree of endemic malaria is almost invariably prevalent. The high incidence of the disease cannot be attributed to any peculiarities of climate, to a difference in the parasite or vector, or even to an abnormal abundance of Anophelines, and it is therefore inferred that economic stress plays a predominant part. Moreover in certain circumstances anti-larval measures, even in association with the distribution of quinine, may be almost valueless unless accompanied by measures that will raise the economic status of the population. In the Punjab there is a striking absence of relationship between the relative prevalence of Anophelines and the local incidence of malaria, and the association of the disease with conditions characterised by a relatively high degree of humidity is conspicuous. A study of the influence of temperature and humidity on the power of the mosquito to acquire and transmit infection [*cf. R.A.E.*, B, ix, 86] indicates that humidity is largely responsible for the association of marshes with malaria, which has hitherto been regarded as almost solely dependent on the fact that they provide an abundance of breeding-places for mosquitos. This also applies to the close association that is frequently found to exist between excessive vegetation and a high local incidence of malaria. Measures designed to prevent flooding, to lower the level of the subsoil water, to improve land drainage and to remove excess vegetation from the vicinity of human habitations may play an important part in reducing malarial incidence by means of their influence on atmospheric humidity, even though they do not lead directly to the destruction of mosquito larvae.

STRICKLAND (C.). **The Success of a Scheme based on our systematic and bionomic Knowledge of Anophelines.**—*Trans. 7th Cong. Far East. Ass. Trop. Med. 1927*, ii, pp. 640–647, 2 pls., 2 charts. Calcutta [1929].

The history of malaria control measures up to the present time is briefly outlined, and an account is given of the successful results obtained on a tea estate in the eastern Himalayan foothills surveyed in 1923 [*R.A.E.*, B, xii, 87], where specific as opposed to general methods of control were employed. The only known malaria carrier found was *Anopheles maculatus*, Theo., which bred abundantly in the stony

water courses, swamps and estate drains. As this species will not breed in jungle, the ground water and springs feeding the swamps were intercepted with drains, and local jungle vegetation was planted in a riband over the drains to cover them completely. Incidentally it supported the banks, which were of light friable soil and were always falling in when the drains were kept clean.

MATSUNO (K.). **On the Malarial Endemic in the central Part of Japan.** —*Trans. 7th Cong. Far East. Ass. Trop. Med. 1927*, ii, pp. 650–654. Calcutta [1929].

Benign tertian malaria is endemic in the central part of Japan, particularly in the vicinity of Lake Biwa. The first cases occur after the middle of June each year ; the number rapidly increases after the middle of July, decreases early in September, increases slightly in the middle of the month and decreases rapidly towards the end, so that there are hardly any cases in October. The only Anopheline is *Anopheles hyrcanus* var. *sinensis*, Wied., which begins to appear between the middle of May and the end of June and entirely disappears in October. No Anopheline larvae are found before the middle of May. Eggs laid in the latter part of the autumn pass the winter in mud, etc., and hatch in the following spring. Females can hibernate in the straws or on the inner side of the straw roofs, but examination of 109 individuals in a malarious district from December to April failed to reveal any malaria parasites in them. Moreover, 27 individuals fed on persons infected with tertian malaria and examined from October to December also showed no parasites. It may thus be supposed that malaria parasites in the body of the mosquito are likely to die when the temperature falls, and there may, therefore, be no cases of malarial infection by hibernating mosquitos.

CLEMESHA (W. W.). **Outbreaks of Malaria occurring in the "Off-season."**—*Trans. 7th Cong. Far East. Ass. Trop. Med. 1927*, ii, pp. 655–660, 1 plan. Calcutta [1929].

An account is given of an outbreak of malaria that occurred in a tea garden about 3,500 ft. above sea-level in Travancore during December, January and February 1926–27 and of certain isolated cases in the early weeks of March in 1926 and 1927. There was no outbreak of malaria on the estate during the previous malaria season (March–May 1926), and no anti-malarial measures had been carried out. Anopheline breeding begins about the first week in March, and the winter cases can only be explained by a temporary activity of hibernating female Anophelines, some of which had been infected in the previous year. The March cases must be due to overwintered Anophelines feeding in February before they oviposit. *Anopheles culicifacies*, Giles, which is an important vector in this district, shows a tendency to hibernate in cow-sheds, which are numerous in very close proximity to the lines. The weather would normally prevent the development of sporozoites in the mosquito at this season, but there is some evidence that in 1926–27 the climatic conditions were less severe and sporozoite formation may have been possible.

RAMSAY (G. C.). **A few Impressions on a Malaria Survey of a Group of Tea Gardens in Assam.**—*Trans. 7th Cong. Far East. Ass. Trop. Med. 1927*, ii, pp. 661–683, 1 plan, 12 refs. Calcutta [1929].

An account is given of a malaria survey of 18 tea gardens in the Cachar District of Assam (which is about 70 ft. above sea level) carried out from 1st July 1926 to 30th June 1927. The following is a list of the Anophelines found, with the percentage of each species : *Anopheles hyrcanus*, Pall., 42·65 ; *A. fuliginosus*, Giles, and *A. philippinensis*, Ludl., 24·12 ; *A. aconitus*, Dön., 8·08 ; *A. vagus*, Dön., 8·06 ; *A. karwari*, James, 6·20 ; *A. kochi*, Dön., 4·03 ; *A. barbirostris*, Wulp, 3·29 ; *A. minimus*, Theo., 2·14 ; *A. aitkeni*, James, 0·73 ; *A. ramsayi*, Covell, 0·25 ; *A. jeyporiensis*, James, 0·17 ; *A. maculatus*, Theo., 0·09 ; *A. culicifacies*, Giles, 0·07 ; *A. leucosphyrus*, Dön., 0·03 ; *A. gigas*, Giles, 0·01 ; *A. jamesi*, Theo., 0·002 ; and *A. tessellatus*, Theo., 0·002. The percentages of *A. fuliginosus* and *A. philippinensis* are given together, as these species were not clearly distinguished until the end of the work, when it was found that 90 per cent. of those identified as *A. fuliginosus* were actually *A. philippinensis*. With the exception of *A. culicifacies* and *A. gigas*, adults of all the species were caught in nature, all being found in human habitations and all but *A. jamesi* and *A. tessellatus* in cow-sheds. Among the species found in human habitations and cow-sheds, a preference for human blood was indicated only in the case of *A. minimus*, *A. ramsayi*, *A. maculatus* and *A. jeyporiensis*, although the numbers of the last three species collected are rather limited for definite conclusions to be formed.

Notes are given on the breeding-places of the various species. In the cold, dry season most of the streams and drains dry up and species, such as *A. minimus*, that normally breed in streams may be found abundantly in permanent pools, abandoned tanks and seepage water. The cold, dry season would appear to be the best time for the employment of larvicides, owing to the concentration of the larvae in the reduced surface waters ; moreover, fewer applications are necessary when the aquatic stages in the mosquito are prolonged by low temperatures. The effect of flooding during the monsoon [*R.A.E.*, B, xiv, 160] is apparent ; low-lying gardens that are easily flooded invariably show a low spleen rate, whereas those on higher ground, with running streams where *A. minimus* breeds, are always highly malarious. The local species of larvivorous fish, *Haplochilus panchax*, *Trichogaster fasciatus*, *Anabus scandens* and *Nuria danrica*, are abundant in swamps, tanks and permanent pools, and to a less extent in low-lying slowly running streams and drains, but they appear to feed on the larvae of harmless species of Anophelines. *A. minimus* is the most important local vector, and whereas no breeding-places of this species could be found in low-lying gardens with a low malaria incidence during the monsoon season, the incidence in the other gardens varied with the prevalence and proximity of its breeding-places to human habitations. The only other Anopheline found naturally infected with sporozoites in Cachar was *A. ramsayi*, which was found in three gardens and appeared to be mainly responsible for the malaria incidence in one low-lying garden where it was prevalent. The part played by other species recorded as natural carriers, such as *A. maculatus*, *A. aconitus*, *A. fuliginosus*, etc., is being investigated.

Although the author considers that further research should be undertaken before extensive and costly anti-malarial measures are attempted in Assam, he suggests that the careful selection of sites for

coolie lines and the flooding of low-lying districts during the monsoon [*cf. loc. cit.*] would reduce the incidence of malaria. Where these measures are not feasible, the conversion of streams and drains into a series of still locks, less favourable for the breeding of *A. minimus* and more effectively oiled, has been carried out with excellent results.

IYENGAR (M. O. T.). **Malaria Survey of Part of the Lower Bengal Delta.**—*Trans. 7th Cong. Far East. Ass. Trop. Med. 1927*, ii, pp. 684–694, 3 pls., 4 plans. Calcutta [1929].

An account is given of a malaria survey of a portion of the Lower Bengal Delta in the neighbourhood of Calcutta. The characteristic feature of the region is an alternation of depressed natural basins in which rain-water collects during the monsoons and ridges formed by the continual silting up of the river banks ; although there is generally a difference of only 15–20 ft. between the levels of the low and high areas, there is a marked difference in the malarial incidence. The nine species of Anophelines collected were : *Anopheles subpictus*, Grassi (*rossi*, Giles), *A. vagus*, Dön., *A. culicifacies*, Giles, *A. fuliginosus*, Giles, *A. pseudojamesi*, Strick. & Chwd., *A. hyrcanus* var. *nigerrimus*, Giles, *A. barbirostris*, Wulp, *A. minimus* var. *varuna*, Iyengar, and *A. tessellatus*, Theo. There is an average annual rainfall of over 60 inches, the greater part of which is confined to the period June–September.

In the rural part of the high riverside areas the spleen rates were found to be very high, sometimes reaching 100 per cent., and malaria is hyper-endemic. These villages are usually dry, but during the monsoon period, the time when the transmission of malaria is greatest, there are numerous shallow ditches and drains that contain sufficient water for Anopheline breeding, and *A. fuliginosus*, *A. tessellatus* and *A. minimus* var. *varuna* are very prevalent. In the municipal and industrial parts of the Hooghly riverside area, where the population is denser, there is a reduction in the prevalence of malaria. In such areas there are fewer collections of water, and these are generally rendered unfit for Anopheline breeding, chiefly by the influx of sullage.

In the low-lying areas the spleen rate is very low and there is very little malaria. Owing to the excess of water, which results in flooding during the monsoon season, the breeding of Anophelines is greatly restricted, particularly in the case of malaria-carrying species. Although at this time breeding of *A. minimus* var. *varuna*, which is the chief carrier in this area, occurs abundantly in the high-lying regions, there is practically none in the low-lying areas ; breeding begins in the latter region a few months later, but by the time the species has reached sufficient numbers to be effective, the transmission season is over. Thus the mere presence of malaria-carrying species is not a deciding factor, the coincidence of an increase in these species with the transmission season being necessary to produce an endemic area.

CLEMESHA (W. W.). **A Note on Malarial Conditions in the Province of Assam.**—*Trans. 7th Cong. Far East. Ass. Trop. Med. 1927*, ii, pp. 698–704. Calcutta [1929].

The author points out the great difficulty of carrying out anti-malaria measures on the tea estates in the plains of Assam. The advent of the rains in April and May and of the monsoon in June

produces the hot, humid conditions that are ideal for prolific mosquito breeding. Anophelines are prevalent from the middle of March until November. Cases of malaria begin to occur about the middle of April, and there is usually a fairly steady increase in their number until September, or even into November in years when epidemics have arisen. The species of Anophelines are numerous and include the following efficient malaria carriers that are frequently met with throughout the hot weather and rains: *A. listoni*, List., *A. maculatus*, Theo., *A. aconitus*, Dön., *A. culicifacies*, Giles, *A. jeyporiensis*, James, and more rarely *A. stephensi*, List. Among the doubtful carriers *A. karwari*, James, and *A. hyrcanus* var. *sinensis*, Wied., are common. The multiplicity of efficient carriers greatly complicates the application of anti-malaria measures, the cost of which is in many cases almost prohibitive. The tea estates under discussion contain practically every known type of breeding-place. The subsoil water level on the plains is so high that small pools and swampy areas dry up very slowly, and, as a consequence, the breeding-places are numerous and remain dangerous for long periods. In many parts of the Duars and the Upper Assam Valley regular lines are not provided for the coolies, who are allowed to construct whatever houses they please, with the result that Anophelines can nearly always be found in them. They are frequently situated on the banks of streams, where *A. maculatus* breeds in numbers. Moreover, as they are seldom collected together on one well-chosen site, the reduction of infection obtained by living in the centre of a large settlement is lost, and the cost of anti-larval measures over the large area covered by the small scattered settlements is greatly increased. Large rice-fields and tracts of jungle often adjoin the estates, and the invasion by Anophelines from these areas is sometimes so great that the reduction in the numbers obtained by anti-larval measures is negligible. It is also necessary that control measures should be carefully supervised, and in most cases the cost of this is prohibitive.

Manalang (C.). **Malaria Control in the Philippines.**—*Trans. 7th Cong. Far East. Ass. Trop. Med. 1927*, ii, pp. 705–711. Calcutta [1929].

The organisation of anti-malaria work in the Philippines is described. Most of the information on mosquitos has already been noticed [*R.A.E.*, B, xvii, 64]. All breeding-places of *Anopheles minimus*, Theo., in a control area are dusted once a week with a 1 per cent. mixture of Paris green and road dust; the Paris green should contain at least 50 per cent. arsenious oxide.

James (S. P.), Nicol (W. D.) & Shute (P. G.). **Habits of *Anopheles* in Relation to their Rôle in the Spread of Malaria. Importance of monthly Differences in the Length of Life of *A. maculipennis*.**—*Trans. 7th Cong. Far East. Ass. Trop. Med. 1927*, ii, pp. 712–717, 3 figs. Calcutta [1929].

Since December 1923 one or more batches of infective mosquitos have been prepared in England every month for use in inducing attacks of malaria in patients suffering from certain mental diseases. Batches of 300 or more adults of *Anopheles maculipennis*, Mg., are collected, fed daily on a suitable case and incubated at 23° C. [73·4° F.] until they become infective. During this procedure, which usually occupies

about a fortnight, many of the mosquitos die. It was found that the percentage that survived to become infective varied greatly in different months; whereas in June less than 2 per cent. survive, at the end of August and during September and October more that 50 per cent. remain alive. The number surviving falls again in November and after remaining at about the same level until March, drops suddenly in May and June and begins to rise again in July. It is believed that the mortality is connected with the maturation of eggs and oviposition. In nearly all females collected in May and June, the ovaries are well-developed, and oviposition must take place in a few days. In those females that succeed in living through this critical time, a second batch of eggs begins to develop almost immediately, and in a few days the mosquito has to go through a second dangerous period, and in the rare case of survival, through a third. This is undoubtedly the cause of the low rate of survival in England during the early summer months. Towards the end of August, there is an almost complete cessation in the growth and maturation of the eggs, a cessation that seems to be independent of atmospheric temperature, for when these mosquitos were fed and incubated as usual, no increase in the size of the ovaries was observed. The drop in the percentage of survivals in November and the subsequent winter months is explained by the fact that the mosquitos have already lived as adults in nature in a hibernating or semi-hibernating condition for some weeks or months, and during this time ovarian development takes place, although it is too slow to be appreciated by the naked eye. Under ordinary circumstances the ova do not show signs of growth until April, but in some mosquitos they are evidently ready for this growth at any time from late November onwards, and some of them begin to grow fairly quickly when the mosquitos are subjected to the artificial heat of the incubator. Their development is not nearly so rapid as in mosquitos caught in May and June, but is sufficient to cause some of the mosquitos to undergo the danger of oviposition during the period of infection.

Examination of monthly collections of females of *A. maculipennis* made by Swellengrebel during 1921–23 in the vicinity of Amsterdam showed that none contained developing ova from October to February, but the percentage rose from 3·9 in March to a maximum of 34 in July and dropped suddenly from 17 in August to 1·4 in September. Thus, these observations on mosquitos caught in nature confirm the view that April–July is the period of egg development and oviposition.

In future, therefore, efforts should be made to correlate the seasonal incidence of primary malaria, not with the seasonal prevalence of the mosquito concerned, but with the seasonal prevalence of individuals that live long enough to transmit the disease. In June there may be enormous numbers of adults of *A. maculipennis* in a malarious region, but their abundance is not so important if it is known that less than 2 per cent. live long enough to become transmitters, and the presence of fewer individuals in August or September may be more important.

Senior-White (R.). **Progress towards the Realization of Biological Control of Mosquito Breeding.** —*Trans. 7th Cong. Far East. Ass. Trop. Med. 1927*, ii, pp. 718–722, 7 refs. Calcutta [1929].

Research on the influence of various chemical and biological constituents of mosquito breeding-places on Anopheline larvae is briefly reviewed [*cf. R.A.E.*, B, xiv, 33; xvi, 204, 247, etc.]. With regard

to the inhibitory effects of very small amounts of saline ammonia, it is stated that the proteids in the nitrogen cycle (determinable as albuminoid ammonia) are broken down to ammonia by a great variety of saprophytic bacteria, but nitrosomonas alone can convert ammonia to nitrites, and nitrobacter alone can continue the conversion to nitrates. Since a bacteriophage has already been isolated for a nitrifying organism, it is thought that by using a modification of the method employed similar bacteriophages may be isolated to inhibit the growth of nitrosomonas and nitrobacter, and so raise the ammonia content of waters to a concentration that will prevent the breeding of malaria-carrying Anophelines.

WILLIAMSON (K. B.). **Chemical Factors in Relation to Anopheline Breeding.**—*Trans. 7th Cong. Far East. Ass. Trop. Med. 1927*, ii, pp. 723–735, 2 figs., 2 refs. Calcutta [1929].

Among the most important problems to be solved in connection with malaria is the reason why the larvae of different species of Anophelines have different habitats and why certain species differ from others in their ability to transmit the disease. It is possible that there may be a correlation between the type of water in which malaria carriers breed and the fact that they are efficient vectors [*cf. R.A.E.*, B, xvi, 69]. For these reasons the author urges further detailed research into the physical, biological and chemical constituents of mosquito breeding-places. The importance of biological chemistry in elucidating these problems is pointed out [*cf.* xv, 68], and arguments based on the observations of various workers on such factors as aquatic vegetation, iron and phosphate contents, pH values, gases in solution, etc., are put forward to show that this science is an essential part of anti-malaria research work [*cf.* xvi, 204, etc.].

CHRISTOPHERS (S. R.) & PURI (I. M.). **Why do *Anopheles* Larvae feed at the Surface, and how?**—*Trans. 7th Cong. Far East. Ass. Trop. Med. 1927*, ii, pp. 736–739, 1 pl. Calcutta [1929].

From observations on the feeding of Anopheline larvae, it appears that although they can feed and apparently nourish themselves on the thin bacterial film that is formed on the surface of water, they normally derive their food from the sub-surface layer. There is a considerable tendency for particles of matter, living and dead, to accumulate in this position without making actual contact with the surface film, and it was also found that flagellates, ciliates and algal organisms frequently collect there in large numbers. It would seem therefore that the object of the larva in feeding at the surface is to tap this special food-supply. A description is given of the means by which both Culicine and Anopheline larvae set up the currents from which they extract their food.

SUR (S. N.) & GHOSH (B.). **A Malaria Survey of Madarihat and its Environs.**—*Ind. Med. Gaz.*, lxiv, no. 10, pp. 558–561, 1 plan. Calcutta, October 1929.

The purpose of this paper is to show the importance of a survey of mosquito conditions before undertaking an anti-malaria campaign in a given locality. In the case in question, it was proposed to drain

certain borrow pits into the nearest river. A mosquito survey of the district proved, however, that the chief breeding-places of at least three dangerous species of Anophelines, namely, *Anopheles culicifacies*, Giles, *A. listoni*, List., and *A. maculatus*, Theo., were not in the borrow pits but in a small stream and pools in an old river bed.

Senevet (G.) & Prunnelle (M.). **Les anophèles d'Algérie. Leur diagnose d'après l'armure génitale des mâles.**—*Arch. Inst. Pasteur Algérie*, vi, no. 4, pp. 468–485, 7 figs. Algiers, December 1928.

Descriptions are given of the genital armatures of the males of the seven known species of Anophelines in Algeria, namely, *Anopheles maculipennis*, Mg., *A. bifurcatus*, L., *A. algeriensis*, Theo., *A. marteri*, Sen. & Prun., *A. hispaniola*, Theo., *A. sergenti*, Theo., and *A. multicolor*, Camb., with a key. Two other species, *A. sacharovi*, Favr (*elutus*, Edw.) and *A. superpictus*, Grassi, have been recorded from Algeria, but their presence has not been confirmed.

Hoffmann (W. H.). **Das gelbe Fieber.** [Yellow Fever.]—*Handb. path. Mikroorg.*, 3rd edn., viii, Lfg. 32, pp. 419–500, 7 figs., 2 pls., 95 refs. Jena, 1929.

This is a general account of the distribution, transmission, and treatment of yellow fever. A bibliography of papers published from 1912 to 1928 is appended.

Roubaud (E.). **Recherches biologiques sur le moustique de la fièvre jaune.** *Aëdes argenteus* **Poiret. Facteurs d'inertie et influences réactivantes du développement. Les oeufs durables et leur importance dans le rajeunissement du cycle évolutif.**—*Ann. Inst. Pasteur*, xliii, no. 9, pp. 1093–1209, 21 figs., 2 pp. refs. Paris, September 1929.

A detailed account is given of further research on the biology of *Aëdes argenteus*, Poir. [*R.A.E.*, B, xv, 161 ; xvi, 183, etc.], with particular reference to the factors influencing the production and metagonic reactivation of "durable" eggs (*i.e.*, those containing inactive larvae). From the results obtained, the author concludes that the durability of these eggs, which has hitherto been regarded as an adaptation enabling the species to survive prolonged periods of dryness or unfavourable winter conditions, in reality provides the means by which the organism reacts against an excess of poison. During the latent period within the egg, which may continue for from several hours in the case of subactive eggs to several months, the primary larva gradually regains the energy and nervous sensibility necessary for hatching and development. The period of asthenobiosis (or state of enforced diapause independent of temperature) is in the primary larvae in durable eggs, as in other insects such as Muscids, *Phlebotomus*, etc., a period of reactivation during which the inhibitory effects of inherited toxins are overcome. The period is not, however, unlimited, and if the stimuli necessary to induce hatching are not present

at a favourable time, the reactivated larva tends gradually to lose its ability to hatch, as do larvae in eggs capable of spontaneous development that are prevented from hatching in a normal period.

The stimuli that induce hatching in durable eggs may be divided into three groups, biological [xv, 93], chemical [xv, 161] and physical and mechanical. Although incomplete results were obtained with most stimuli in the last category [xv, 161], subjection for prolonged periods to anhydrobiosis or to low temperatures in water brought about the reactivation of the larvae, which were then induced to hatch in the first case by immersion in water and in the second by the same mechanical stimuli, such as shaking, changes in the medium, etc., that induce hatching in active eggs.

The factors determining the inactivity of the durable eggs are discussed. The females laying the eggs may either be active, depositing their eggs four to five days after a single blood meal, or retarded, in which case two or more blood meals are necessary for maturation of the eggs, which are laid after longer intervals of time. This retardation may be due to several factors. Females requiring only one blood meal before laying their first batch of eggs, required two or more blood meals and a longer period for the maturation of their eggs in the case of the second batch, so that the age of the female is one factor. Over-population and the consequent diminution in the nourishment available for each larva results in a reduction in size and rate of development of some individuals, the retardation in physiological activity being subsequently manifested in the delayed oviposition of the females produced. Moreover, the accumulation of excretory products appears to exert a toxic effect on the larvae, causing them to undergo a secondary diapause in the last instar that delays or completely prevents transformation. Female larvae appear to be more affected than male larvae, and, should they survive, produce retarded adults after a greatly prolonged period of development. Finally, retarded females may be produced as a consequence of hereditary fatigue related to the excess metabolic activity of generations maintained continuously at high temperatures ordinarily favourable to the development of the mosquito. In all cases the retardation of the females results in the production of a greatly increased proportion of durable eggs. The production of durable eggs by females retarded through cyclic fatigue shows that the mosquito is heterodynamic, but the alternating phases of asthenia and metabolic activity are not definitely marked, since the eggs laid are practically never all active or all durable. As the durable egg is correlated with a state of fatigue, the time spent in it is necessary to confer on the resulting females a certain degree of activity characterised by the production of active eggs ; the proportion of active eggs produced is higher the longer the latent period in the egg. The activity may be retained by the progeny of active females provided their development takes place at low temperatures (hypothermobiosis), but inactivity reappears when development occurs continuously at high temperatures representing the normal optimum (25–30° C. [77–86° F.]).

The conclusions reached as to the nature of and reason for the production of durable eggs may be applied to all species of *Aëdes*.

Observations on the oviposition of *A. argenteus* showed that the eggs are deposited for preference on organic material capable of decomposition, and on the water itself provided it contains sufficient organic matter. The choice of such sites is an adaptation of the species to the

various reactivating agents that favour its development. If micro-organisms are scarce in the water or on the walls of the container, the eggs are laid out of the water, where they may undergo a period of anhydrobiosis favourable to the reactivation of the young larvae. The females do not, however, appear to distinguish between active and durable eggs, and the former frequently die by desiccation after being deposited above the surface of the water. If, on the other hand, the water contains micro-organisms capable of producing the soluble ferments necessary for the reactivation of the larvae in a short time, the eggs are deposited on the surface.

With regard to the practical application of the information obtained, it is pointed out that penalisation of householders whose water containers are found to contain larvae is unjust in that, even if the water is changed every day, the unobserved presence of durable eggs on the walls of such containers may result in the hatching of larvae in a few seconds owing simply to the effect of shock and agitation of the liquid when the fresh water is poured in. It is therefore suggested that attention should be directed to the destruction of the latent eggs by carefully scouring the interior of the containers, scorching them with a blow-lamp, etc., or, where these measures are too laborious, by sterilising them with sodium hypochlorite [xv, 161]. Sterilisation might be carried out once a month during the period of activity of the mosquito, and less often during the dry, cool season, but it must be continued with renewed vigour once the rains begin, for the durable eggs reactivated by a prolonged period of anhydrobiosis are then capable of hatching in enormous numbers.

TERDSCHANIAN (A.). **Die Malaria in Dagestan.**—*Arch. Schiffs- u. Tropenhyg.*, xxxiii, no. 11, pp. 587–592, 4 refs. Leipzig, November 1929.

Malaria is severe and endemic in Daghestan (North Caucasus), its incidence being favoured by river floods and primitive irrigation methods, which are responsible for mass-breeding of Anophelines, and by the poverty of the population and the complete absence of prophylactic measures. The Anophelines found are *Anopheles maculipennis*, Mg., *A. hyrcanus* var. *pseudopictus*, Grassi, *A. sacharovi*, Favr, and *A. algeriensis*, Theo. In summer, smoke fires are used to protect the cattle against the swarms of mosquitos.

The sandflies, *Phlebotomus papatasii*, Scop., and *P. major* var. *perniciosus*, Newst., are also found in Daghestan.

[ZOLOTNIKOVA (I. E.).] **Золотникова (И. Е.). Observations on** *Anopheles plumbeus* **Hal., in Sukhum.** [*In Georgian.*]—*Nachr. trop. Med.*, ii, no. 7, pp. 505–508. Tiflis, September 1929. (With Summaries in Russian and German, pp. 549 & 553.)

Anopheles plumbeus, Steph., is widely distributed in Abkhasia (Georgia), being especially abundant in forests near the town of Sukhum, where it breeds in tree holes. The larvae also occur in various domestic containers and accidental collections of stagnant water. In winter, development from egg to adult is completed in about 4½ months; larvae that hatched on 4th December developed throughout the winter,

the average temperature of the water in the hollows of trees being 5–10° C. [41–50° F.], and pupated at the end of March, the adults emerging on 6th April. Several generations are produced between May and October. In hot summers many of the larvae are killed, owing to evaporation of the water in the tree holes. No adults have been found in winter, but larvae occurred alive even under a layer of ice in the hollows of trees.

[Dmitriev (I. D.).] **Дмитриев (И. Д.). Rapports entre le facteur eau et la densité anophélienne et entre cette dernière et la morbidité palustre.** [*In Russian.*]—*Russ. J. Trop. Med.*, vii, no. 5, pp. 318–325, 3 refs. Moscow, 1929.

From studies in Batum in 1926-27, the author concludes that there is a direct relation between the numbers of mature larvae of *Anopheles maculipennis*, Mg., and of the adults in houses, the incidence of malaria being closely related to the latter. Measures that only effect a partial control of the larvae will therefore reduce the incidence of the disease. Near Batum, the first larvae appear in the middle of May, and the first adults are found in inhabited houses at the beginning of July, the earliest primary cases of malaria occurring in the middle of the month.

[Nabokov (V. A.).] **Набоков (В. А.). Sur la désinsectisation à froid par l'anhydride sulfureux.** [*In Russian.*]—*Russ. J. Trop. Med.*, vii, no. 5, pp. 349–354, 2 refs. Moscow, 1929.

As fumigation by burning sulphur against mosquitos hibernating in buildings is attended by risk of fire, laboratory experiments were carried out on the use of sulphur dioxide released from sodium sulphite in earthenware jars by means of sulphuric acid. To obtain a 1 per cent. concentration of sulphur dioxide to 1,000 cu. ft. of space, 112 oz. sodium sulphite and 40 oz. sulphuric acid are required. As the gas is heavy, the jars should be placed as high as possible to obtain an even concentration. Sulphur dioxide produced in this way did not damage textiles, even at a 10 per cent. concentration, whereas when obtained by burning sulphur it often severely injures them ; moreover a given concentration of gas is obtained much more quickly, and it does not change for several hours. On the other hand, the cost of materials is much greater. It would be possible to fumigate a cellar from the room above by placing the jars on the floor and allowing the gas to penetrate through cracks in it.

[Nabokov (V. A.) & Solov'ev (V. V.).] **Набоков (В. А.) и Соловьев (В. В.). La désinsectisation par la chloropicrine en chambre.** [*In Russian.*]—*Russ. J. Trop. Med.*, vii, no. 5, pp. 354–356. Moscow, 1929. (With a Summary in French.)

In view of frequent outbreaks of typhus in various parts of Russia, studies on methods of fumigation against lice [*Pediculus humanus*, L.] in clothes, etc., are being carried out. The authors are of the opinion that chloropicrin, the properties of which are discussed, is

the best material. In experiments, 30 minutes exposure at 25–30° C. [77–86° F.] to a 0·5 per cent. concentration, produced by using 20–25 cc. of chloropicrin to 35 cu. ft. of space, the liquid being sprayed on a hot iron sheet inside the fumigation chamber, killed all lice and other insects contained in glass tubes with cotton-wool stoppers and placed under three layers of cloth, inside a folded fur coat, etc. A description is given of a fumigation chamber mounted on wheels for use in treating workmen's clothing in the open. It is heated by a small radiator fixed to the bottom so that it can be used at outdoor temperatures.

PAPERS NOTICED BY TITLE ONLY.

HALL, jr. (D. G.). **The North American Species of** *Sarcophaga* **belonging to the "A" Group (Dip.: Sarcophagidae).**—*Ent. News*, xl, no. 10, pp. 319–324, 2 figs. Philadelphia, Pa., December 1929.

HALL, jr. (D. G.). **An annotated List of the Sarcophaginae which have been collected in Kansas.**—*J. Kansas Ent. Soc.*, ii, no. 4, pp. 83–90, 13 refs. McPherson, Kans., October 1929.

BARANOFF (N.). **Beitrag zur Kenntnis der Gattung** *Sarcophaga* **(Mg.) Boettcher (Dipt., Tach.).** [A Contribution to the Knowledge of the Genus *Sarcophaga*.]—*N. Beitr. syst. Insektenk.*, iv, no. 13–14, pp. 142–153, 1 pl. Berlin, 1st October 1929.

THOMPSON (W. R.). **A Contribution to the Study of Morphogenesis in the Muscoid Diptera.**—*Trans. Ent. Soc. Lond.*, lxxvii, pt. 2, pp. 195–244, 30 figs. London, 31st December 1929.

IOFF (I. G.). **Zur Systematik und Oekologie der Flöhe der Springmäuse (Dipodidae).** [The Classification and Ecology of the Fleas of Jerboas in S.E. Russia and Transcaspia.]—*Zool. Jahrb.*, Syst., lviii, no. 3, pp. 359–388, 15 figs., 8 refs. Jena, 22nd November 1929.

GOYLE (A. N.). **Experiments on the Transmission of Plague by** *X[enopsylla] cheopis* **and** *X. astia.*—*Trans. 7th Cong. Far East. Ass. Trop. Med. 1927*, ii, pp. 35–39, 7 refs. Calcutta [1929]. [*Cf. R.A.E.*, B, xvi, 223.]

WU LIEN-TEH. **The Perpetuation of Plague among wild Rodents.**—*Trans. 7th Cong. Far East. Ass. Trop. Med. 1927*, ii, pp. 44–63, 21 refs. Calcutta [1929]. [See *R.A.E.*, B, xvi, 267.]

MEGAW (J. W. D.). **Typhus-like Fevers conveyed by Ticks.**—*Trans. 7th Cong. Far East. Ass. Trop. Med. 1927*, ii, pp. 509–516. Calcutta [1929]. [*Cf. R.A.E.*, B, ix, 214; xiii, 66, 176; xvi, 233.]

KINGSBURY (A. N.). **An Attempt to transmit** *L[eptospira] icterohaemorrhagiae* **by** *A[ëdes] argenteus* **and** *A. albopictus.*—*Trans. 7th Cong. Far East. Ass. Trop. Med. 1927*, ii, pp. 544–547, 3 refs. Calcutta [1929]. [*Cf. R.A.E.*, B, xvii, 12.]

BABLET (J.) & MESNARD (J.). **Le typhus exanthématique au Tonkin.**—*Trans. 7th Cong. Far East. Ass. Trop. Med. 1927*, ii, pp. 548–550. Calcutta [1929]. [*Cf. R.A.E.*, B, xvi, 251.]

MORIN (H. G. S.). **Note sur la pathogénie de la dengue.**—*Trans. 7th Cong. Far East. Ass. Trop. Med. 1927*, ii, pp. 552–553. Calcutta [1929]. [*Cf. R.A.E.*, B, xvi, 251.]

James (S. P.). **Remarks on Anti-malarial Measures for Poverty-stricken Regions.**—*Trans. 7th Cong. Far East. Ass. Trop. Med. 1927*, ii, pp. 609–612. Calcutta [1929]. [*Cf. R.A.E.*, B, xv, 197.]

Scharff (J. W.). **Malaria—Mosquito Control in rural Singapore.**—*Trans. 7th Cong. Far East. Ass. Trop. Med. 1927*, ii, pp. 613–623, 1 map. Calcutta [1929]. [*Cf. R.A.E.*, B, xvi, 67, 100.]

Mayne (B.). **Initial seasonal Appearance of Malaria in a selected Area in India, demonstrated by Presence of Parasites in the Insect Carrier.**—*Trans. 7th Cong. Far East. Ass. Trop. Med. 1927*, ii, pp. 740–744. Calcutta [1929]. [*Cf. R.A.E.*, B, xvi, 226.]

Mayne (B.). **A Note on some experimental Attempts to transmit mechanically Malaria Organisms through Mosquito Biting.**—*Trans. 7th Cong. Far East. Ass. Trop. Med. 1927*, ii, pp. 745–748. Calcutta [1929]. [See *R.A.E.*, B, xvi, 225.]

Peus (F.). **Ueber variable Culiciden-Hypopygien.** [Concerning Variations in the Hypopygia of Mosquitos.]—*Zool. Anz.*, lxxxvi, no. 5–6, pp. 120–123, 6 figs., 2 refs. Leipzig, 20th December 1929.

Taylor (F. H.). **Notes on Australian Culicidae (Dipt.)** [including 4 new Species].—*Bull. Ent. Res.*, xx, pt. 3, pp. 271–277, 1 pl., 2 refs. London, October 1929.

de Buen (F.). **La invasión de nuestras aguas dulces por las Gambusias (*Gambusia holbrooki* Grd.).** [The Establishment and Natural Increase of *G. holbrooki* in fresh Waters in Spain.]—*Rev. Biol. forest. Limnol.*, Ser. A, i, no. 1, pp. 49–53, 5 refs. Madrid, 31st October 1929. (With a Summary in French.)

Roubaud (E.) & Colas-Belcour (J.). **Action des diastases et des facteurs microbiens solubles sur l'éclosion des oeufs durables du moustique de la fièvre jaune** [*Aëdes argenteus*, Poir.]. **Recherches expérimentales.**—*Ann. Inst. Pasteur*, xliii, no. 5, pp. 644–655, 4 refs. Paris, May 1929. [*Cf. R.A.E.*, B, xv, 93.]

Hoffmann (W. H.). **Europa und das Gelbfieber.** [The Danger of the Introduction of Yellow Fever into Europe.]—*Münch. med. Wschr.*, 1929, no. 39, p. 1623 (reprint 16 pp.). Munich, 1929. [*Cf. R.A.E.*, B, xv, 80.]

De Meillon (B.). **Some Ceratopogoninae from the Transvaal.**—*Trans. Ent. Soc. Lond.*, lxxvii, pt. 2, pp. 245–249, 3 figs. London, 31st December 1929.

Vimmer (A.). **Nové Palestinské druhy se sběru Bodenheimerova.** [New Species of *Forcipomyia* from the Collection of Bodenheimer from Palestine.]—*Čas. československ. Společn. ent.*, xxv, no. 3–4, pp. 55–60, 1 fig. Prague, October 1928. (With a Summary in German.)

Franchini (G.). **Ixodidi delle Colonie italiane dell'Africa del nord e dell'Africa orientale.** [Ticks of the Italian Colonies of North and East Africa.]—*Cong. intern. Zool.*, x (1927), pt. 2, pp. 1139–1141. Budapest, 1929. [See *R.A.E.*, B, xvii, 144.]

Kligler (I. J.). **Studies on the Etiology of Phlebotomus and Dengue Fever. iii.—The Transmission of Dengue Fever to Monkeys.**—*Trans. R. Soc. Trop. Med. Hyg.*, xxiii, no. 2, pp. 193–196, 3 refs. London, 26th August 1929.

[Popov (P. P.).] **Попов (П. П.). La répartition géographique de *Phlebotomus* en l'U.R.S.S. et les maladies qu'ils propagent.** [*In Russian.*]—*Russ. J. Trop. Med.*, vii, no. 5, pp. 358–364, 1 fig., 36 refs. Moscow, 1929.

The author discusses the possibility of determining the relation of the distribution of *Phlebotomus* spp. in the Russian Union to that of sandfly fever and dermal and visceral leishmaniasis. Sandfly fever is of frequent occurrence in Turkestan, the Crimea and Transcaucasia. The sandflies recorded in Turkestan are *P. major*, Ann., *P. major* var. *perniciosus*, Newst., *P. sergenti*, Parrot (*caucasicus*, Marz.), *P. li*, Popov, *P. minutus*, Rond., *P. papatasii*, Scop., *P. duboscqui*, Nev.-Lem., and *P. mascittii*, Grassi, and several of these species occur in Transcaucasia and the Crimea. Although the disease is also found along the Black Sea coast of Georgia, no sandflies have been observed there ; on the other hand *P. major* var. *perniciosus* has been recorded from Odessa, where the fever is absent. Oriental sore occurs in Turkestan, Transcaspia and Azerbaijan, and is nowhere found in the absence of *Phlebotomus*. Visceral leishmaniasis has frequently been recorded in Turkestan and Transcaucasia and is possibly transmitted by *P. major* var. *perniciosus* ; *P. argentipes*, Ann. & Brun., which is associated with kala-azar in India, does not occur in the Russian Union. Cases of visceral leishmaniasis, however, have also been observed in the Mogilev Government (White Russia) and in western Siberia (near Ural), where no sandflies have been recorded.

Lesne (P.). **Sur la distribution des glossines dans la région du Zambèze de Chemba (Afrique orientale portugaise).**—*C.R. Acad. Sci. Fr.*, clxxxix, no. 27, pp. 1313–1314, 1 map. Paris, 1929.

A sketch map is given showing the exact distribution of *Glossina morsitans*, Westw., and *G. pallidipes*, Aust., in the valley of the Zambezi in Portuguese East Africa. *G. austeni*, Newst., apparently not hitherto recorded from the Zambezi basin, occurs sporadically in the forest on the left bank of the Nhamapaza, south of Maringué.

Chorley (J. K.). **The Bionomics of *Glossina morsitans* in the Umniati Fly Belt, Southern Rhodesia, 1922-23.**—*Bull. Ent. Res.*, xx, pt. 3, pp. 279–301, 5 figs., 10 refs. London, October 1929.

A detailed account is given of investigations carried out during 1922–23 on the bionomics of *Glossina morsitans*, Westw., in Southern Rhodesia. Observations were made on breeding-places, large quantities of puparia were collected for breeding out parasites, and regular comparable density counts were carried out, much of the data obtained being shown in numerous tables. The following is largely taken from the author's summary. The pupal period was three to four times as long in winter as it was in summer, being approximately 70 days in June and only 21 days in November. Breeding continues throughout the year, but the period of greatest density and activity is in September, towards the end of the dry season. During heavy continued rains in February and March, when the forest was in full leaf and the grass was long, puparia were fairly abundant and density counts did not indicate any lack of nourishment [*cf. R.A.E.*, B, ii, 95]. The grass in belts of savannah forest consisting mainly of *Copaifera mopane*

(9598) Wt P4/3520 1,700 3/30 H & Sp Gp 52 4

does not, however, grow very long. All types of forest were used for breeding, except dense forest close to the river banks consisting chiefly of evergreens [*cf.* xvi, 107]. In the mopane forest a great reduction in numbers occurred after leaf-fall. At the end of the dry season the dry bed of a small well-shaded stream was extensively used as a breeding-place. Dense thorn thickets and overgrown gullies were only used as breeding-places after most of the leaves had fallen.

The puparia were attacked by at least seven species of parasites, namely, the Mutillids, *Mutilla glossinae*, Turn., and *M. benefactrix*, Turn., the Chalcids, *Brachymeria* (*Chalcis*) *varipes*, Wlk., *Stomatoceras exaratum*, Wtrst., *Dirhinus* sp., *Eupelminus tarsatus*, Wtrst., and *Syntomosphyrum glossinae*, Wtrst., and a Bombyliid, *Thyridanthrax* (probably two species). *M. glossinae* and the Bombyliid are of considerable economic importance, the others being rare or only occasional parasites. *Syntomosphyrum* was easy to rear in large numbers in the laboratory, but in nature under the most favourable conditions of temperature not more than 2 per cent. of the collected puparia were parasitised by it. Experiments showed that it cannot burrow for more than $\frac{1}{8}$ to $\frac{1}{4}$ inch into light soils, and under natural conditions, most of the puparia of *G. morsitans* are well-covered with soil or vegetable débris. The parasites showed definite seasonal activity, and at the end of the dry season 84 per cent. of the pupae from which insects emerged were parasitised.

The percentage of collected puparia that failed to yield either flies or parasites increased from 23 in March to 60 in November. Experiments showed that half an hour's exposure to the sun (118° F.) is sufficient to kill puparia even when covered with about an inch of sand, and the combined effect of parasitism and exposure to the hot summer sun is probably a contributary cause of the great decrease in density of flies that occurs throughout the mopane forest at the end of the late dry season after leaf-fall is complete. This statement does not necessarily apply to other areas not examined. The fly belt under discussion has continued to spread and the game has increased, although the area has been thrown open to free shooting since 1905. Between 1924 and 1925 the spread eastward has been rapid, and new settlement areas have been endangered.

Paine (R. W.) & Edwards (F. W.). **Mosquitos from the Solomon Islands.**—*Bull. Ent. Res.*, xx, pt. 3, pp. 303–316, 2 pls., 2 figs. London, October 1929.

An annotated list is given of 23 species of mosquitos found in the British Solomon Islands Protectorate during the period August–October 1928, including *Anopheles punctulatus*, Dön., *Aëdes* (*Stegomyia*) *argenteus*, Poir., *A.* (*Aëdimorphus*) *imprimens*, Wlk., *A.* (*Aëdes*) *funereus* var. *ornatus*, Theo., and *Armigeres malayi* var. *breinli*, Taylor, which readily attack man. Systematic notes by F. W. Edwards on this material include descriptions of two new species and two new varieties.

Edwards (F. W.). **Mosquito Notes. VIII.** *Bull. Ent. Res.*, xx, pt. 3, pp. 321–343, 4 figs. London, October 1929.

This paper is divided into several sections, one of which deals with some varieties of African and Oriental Anophelines. The African

forms described are *Anopheles rufipes*, Gough, the distribution of which is indicated; *A. rufipes* var. *ingrami*, n., from the Gold Coast and Nigeria; and *A. theileri*, Edw., from the Transvaal and the Belgian Congo, with three new varieties of it, *viz.*, *brohieri* from the Gold Coast, *hancocki*, from Uganda and Nigeria, and *seydeli*, from the Belgian Congo. The characters distinguishing *A. gigas* var. *refutans*, Alcock, from Ceylon and *A. gigas* var. *baileyi*, n., from Tibet and Western China are given. *A. lindesayi* var. *cameronensis*, n., is described from the Malay Peninsula. The following local varieties of *Anopheles hyrcanus*, Pall., are re-defined: *pictus*, Lw., from Palestine, Macedonia and Mesopotamia; *pseudopictus*, Grassi, from Italy, Macedonia and the Caspian region; *mesopotamiae*, Chr., from Mesopotamia; *sinensis*, Wied., from China, Japan, Formosa, the Malay Peninsula and possibly India; and *nigerrimus*, Giles (*peditaeniatus*, Leic.) from India, Ceylon, the Malay Peninsula, Borneo, Siam and the Philippine Islands.

Eretmopodites chrysogaster, Graham, has recently been shown experimentally to be capable of transmitting yellow fever [*R.A.E.*, B, xvi, 236] and may possibly be of some economic importance. The species of this genus are discussed, and a key is given to the known larvae and pupae.

Calvo Criado (V.). **La actual epidemia de dengue en Andalucía.** *Med. Países cálidos*, i, no. 3, pp. 250–257.

Castejón (R.). **La epidemia del "colorado" en Andalucía.** *T.c.*, pp. 258–260. Madrid, May 1928.

These papers refer to an outbreak in summer of 1927 of fever which was of mild character resembling sandfly fever, though the symptoms in some cases were typical of dengue. The second author discusses the divergent views of various workers on the vectors and possible identity of sandfly fever and dengue [*cf. R.A.E.*, B, xvii, 167, 238]. Both *Phlebotomus papatasii*, Scop., and *Aëdes argenteus*, Poir. (*Stegomyia fasciata*, F.) occur in Andalusia.

Mochtar (A.). **Filaria-onderzoek te Benkoelen en Omstreken.** [Filaria Investigation at Benkoelen and its Environs.]—*Geneesk. Tijdschr. Ned.-Ind.*, lxix, no. 10, pp. 967–974. Weltevreden, 1st October 1929.

In Sumatra, 300 females of *Aëdes argenteus*, Poir. (*aegypti*, L.) previously kept fasting were fed by night on the blood of persons infected with filariasis, believed to be due to *Filaria malayi*, but dissection a week after the first meal failed to reveal the parasite.

[Bogdanov (E. A.).] **Богданов (Е. А.). Ueber die verwandschaftliche Verhältnisse der** *Calliphora erythrocephala* **und** *Phormia coerulea*. [On the Relationship between the common Bluebottle Fly (*Calliphora erythrocephala*) and *Phormia coerulea*. (*In Russian.*)] —*Nauchno-Agron. Zh.* [*Sci.-agron. J.*], 1929, no. 7–8, reprint 13 pp., 1 fig., 1 ref. Leningrad, 1929. (With a Summary in German.)

In the course of laboratory studies in 1924–28 on the breeding of mutants of *Calliphora erythrocephala*, Mg., numerous individuals

morphologically identical with *Phormia coerulea*, R.-D., were obtained in six instances and at various periods from pure cultures of the former. The author discusses this phenomenon in detail, but is unable to explain it. He states that cross-breeding between the flies under experiment and wild *P. coerulea*, or contamination of the cultures by the latter was impossible. The laboratory adults of *Phormia* were physiologically different from the wild species, and possessed pathological characters typical of the mutants of *C. erythrocephala*.

Kinoshita (S.) & Yajima (T.). **Species of Tabanids attacking Horses with Examples of their seasonal Prevalence.** [*In Japanese.*]—*Res. Bull. Vet. Inst.*, no. 12, pp. 355–364. Tokyo, 1929.

In Japan 21 species of Tabanids, a list of which is given, are known to attack horses, 15 species attacking cattle. *Tabanus cordiger*, Mg., is the most abundant, *T. chrysurus*, Lw., *T. sapporoensis*, Shir., and *T. mandarinus*, Schin., being also very numerous. The flies appear in June, and reach their maximum numbers in July, disappearing in late September or October.

Kobayashi (H.). **General Survey on the seasonal Prevalence of the House-fly in Chosen. First Report : Researches during 1928.**—*Acta medicinalia in Keijo*, xii, fasc. 2, pp. 59–65, 18 charts. Keijo, Imp. Univ., 1929.

Collections of *Musca domestica*, L., were made by means of adhesive fly-papers throughout 1928 in each provincial government in Korea. The results obtained in 18 localities, which are given in charts, show that flies are active in numbers even in winter in many localities. Their highest prevalence does not necessarily coincide with the highest temperature, and their numbers often decrease at midsummer. Flies are most numerous between April and November, when the temperature is always above 10° C. [50° F.], there being usually two periods of special prevalence, from April to June and from September to October, when the temperature varies between 10 and 20° C. [50–68° F.]. In certain cases a midsummer prevalence was also observed.

Bodenheimer (F. S.) & Theodor (O.). **Beobachtungen über hygienisch wichtige Insekten des Sinai.** [Notes on the Insects of Sinai of hygienic Importance.]—*Ergebnisse der Sinai-Expedition 1927*, pp. 37–39. Leipzig, 1929.

There is little malaria in the Sinai peninsula, which is very dry ; the only mosquitos observed were *Anopheles sergenti*, Theo., *A. superpictus*, Grassi, and *Culex perexiguus*, Theo. Other noxious Diptera recorded include *Tabanus rupinae*, Aust., *T. accensus*, Aust., and *T. leleani*, Aust., the last two attacking camels, *Hippobosca camelina*, Leach, *H. equina*, L., *Wohlfartia nuba*, Wied., and *Cephalopsis titillator*, Clark. The ticks, *Hyalomma aegyptium*, L., *Boophilus annulatus*, Say, and *Rhipicephalus sanguineus*, Latr., were taken in small numbers.

Morishita (K.). **On the parasitic Flagellates in** *Triatoma rubrofasciata* **(De Geer) in Formosa and the Trypanosomes obtained in Infection Experiments with them. Preliminary Communication.** [*In Japanese.*]—*Dobuts. Z.* [*Zool. Mag.*], xli, no. 846, pp. 178–183. Tokyo, 1929. (Abstract in German in *Jap. J. Zool.*, ii, no. 4, p. (109). Tokyo, 30th November 1929.)

A flagellate resembling a developmental stage of *Trypanosoma cruzi* was found in *Triatoma rubrofasciata*, DeG., in Formosa. Experimental infection of mice produced a trypanosome differing from *T. cruzi* and not pathogenic to them.

Lamborn (W. A.). **Medical Entomologist's Report.**—*Ann. Med. Rep. Nyasaland 1928*, pp. 35–38. Zomba, 1929.

At the end of the rains in 1927, *Glossina* [*morsitans*, Westw.] appeared in considerable numbers at many points south of the barrier zones of deforested land created in 1926 [*R.A.E.*, B, xvi, 157], but in February 1928 it was found to have receded from the newly invaded areas during the dry season. From March to June the clearings were greatly extended, but in April and May it appeared in the places in which it had been found at the same season in 1927, south of the clearings, and by June the increase had become generalised, and it was abundant over an area much larger than that previously involved. The flies were able to find adequate shelter in the coarse high grass that occupied almost the whole of the clearings, since it could not be kept down over so large an area. Their movement was so large, and took place over so extensive an area, that it suggested a wholesale migration ; it was not directly associated with the movement of game. The activity of the flies in open country during the middle of the day was noticeable ; in the cool season, and at an altitude of 3,500 feet, they apparently do not avoid direct sunlight. A further survey in September showed that *G. morsitans* was maintaining itself in the newly invaded areas ; puparia were found in them.

In view of the spread of the tsetse-fly to the south of the barriers, the original scheme has been abandoned, but it has been decided to clear a belt of forest along the north bank of the Libuni river, at least 20 miles to the south of the present tsetse-fly line. The proposed zone will extend for some 17 miles between mountainous areas unsuitable for the fly, and will be 2–3 miles wide. Native settlement will be concentrated in the zone, and provision will be made for the destruction of game in it. European settlement to the north of the zone will be encouraged.

Negative results were obtained in experiments to test the possibility of cyclical transmission of *Trypanosoma congolense* in dogs by the tick, *Rhipicephalus sanguineus*, Latr. Large numbers of ticks, allowed to engorge in the larval stage on an infected animal, failed to infect a healthy animal on which they fed in the nymphal and adult stages ; similarly, large numbers of ticks, fed as nymphs on an infected animal, failed to cause infection when adult.

In rearing ticks for experimental purposes, it was found that eggs of *R. sanguineus*, *R. appendiculatus*, Neumn., and *Haemaphysalis* sp. (probably *H. leachi*, Aud.) hatched in about a month, whereas those of a species of *Amblyomma* (probably *A. hebraeum*, Koch), laid just

before the rains, remained dormant for four months of the wet season, and began to hatch only as it drew to a close.

That *Anopheles gambiae*, Giles (*costalis*, Theo.) and *A. funestus*, Giles, the common vectors of malaria in Nyasaland, gradually disappear after the cessation of the rains, at the higher altitudes of 3,000 feet and upwards, and do not reappear until the wet season is well advanced, was confirmed. At the level of Lake Nyasa, however, *A. funestus* persists throughout the year [xiii, 107]. The Anophelines found in the hill country during the dry season are *A. pretoriensis*, Theo., which rarely frequents houses, *A. rhodesiensis*, Theo., and *A. longipalpis*, Theo. None of these three species has yet been incriminated as a carrier of malaria. Monthly blood examinations of forty native children living at an altitude of about 3,000 feet showed that the malaria parasite rate fell almost to nil when the dry season was far advanced, in October and November, whereas a marked rise took place shortly after the rains, in April and May, after which a drop occurred. No diminution in the parasite rate takes place at lake level.

Plasmodium was found in blood films from three out of five baboons (*Cynocephalus pruinosus*) shot in a ravine in which *A. pretoriensis*, *A. rhodesiensis* and *A. longipalpis* breed.

LARROUSSE (F.). **Hôtes intermédiaires nouveaux d'un cestode de la souris : *Hymenolepis microstoma* (Dujardin, 1845).**—*C.R. Soc. Biol.*, c, no. 11, pp. 855–857, 1 fig., 2 refs. Paris, 1929.

In an investigation of insects living in the cages in which mice were reared for laboratory purposes in Strasbourg, the author found the cysticercoids of *Hymenolepis microstoma* in the Tenebrionid, *Gnathocerus cornutus*, F., and in the Trogositid, *Tenebroides* (*Trogosita*) *mauritanicus*, L., two beetles not previously recorded as intermediate hosts of this Cestode, as well as in *Tenebrio molitor*, L., and a flea, *Ceratophyllus fasciatus*, Bosc.

Cysticercoids were found in 82 per cent. of the females, 56 per cent. of the males and 20 per cent. of the larvae of *G. cornutus*. This beetle is very small, and the chitin of its exoskeleton is thin ; it is therefore readily eaten by the mice with their food, and since it is also very common in the cages, it is an ideal intermediate host for the Cestode. Cysticercoids were found in 16 per cent. of the adults and 2 per cent. of the larvae of *T. mauritanicus* ; this beetle is much larger and has a thick chitinous covering, and it is doubtless rarely eaten by the mice.

Teratological forms of the cysticercoid of *H. microstoma* have been recorded previously ; such forms were invariably found in *T. mauritanicus*. The author suggests that these forms occur when an infested individual of *G. cornutus* is eaten by *T. mauritanicus*, the latter beetle becoming a secondary, and abnormal, intermediate host.

BACIGALUPO (J.). **Un nuevo huésped intermediario del *Hymenolepis diminuta* (Rudolphi 1819), el *Ulosonia parvicornis* Fairmaire 1892.**—*Semana méd.*, xxxvi, no. 21, pp. 1339–1340, 2 figs. Buenos Aires, 23rd May 1929.

Cysticercoids of *Hymenolepis diminuta* were found in the body cavity of two out of three adults of the Tenebrionid, *Ulosonia parvicornis*, Fairm., from laboratory rat cages in Buenos Aires. This

beetle is considered to be the normal intermediate host of *H. diminuta* in Argentina. The Cestode was not found in four larvae of *U. parvicornis* from the same place.

HALL (M. C.). **Arthropods as intermediate Hosts of Helminths.**—*Smithson. Misc. Coll.*, lxxxi, no. 15, 77 pp. Washington, D.C., 25th September 1929.

Lists are given of the Cestodes, Trematodes, Nematodes and Acanthocephala that are known to have vertebrates as their primary, and Arthropods as their intermediate hosts, showing the primary and intermediate hosts of each species. The Arthropod intermediate hosts are also listed, with the worms recorded as developing in each.

HEARLE (E.). **Insects of the Season 1928 in British Columbia. Insects affecting Live Stock and Man.**—*59th Ann. Rep. Ent. Soc. Ontario 1928*, pp. 35–37. Toronto, 1929.

Blood-sucking Diptera were very troublesome in various parts of the range-lands of British Columbia in 1928, the species concerned including *Simulium venustum*, Say, *S.* (*Prosimulium*) *fulvum*, Coq., *S.* (*Prosimulium*) *novum*, Dyar & Shannon, *S. virgatum*, Coq., *S. vittatum*, Zett., *S.* (*P.*) *hirtipes*, Fries, *S.* (*P.*) *pleurale*, Mall., *Tabanus osburni*, Hine, *T. sequax*, Will., *T. punctifer*, O.S., and the Leptid, *Symphoromyia atripes*, Bigot, which was exceptionally numerous, horses being rendered almost unmanageable by it.

DETWILER (J. D.). **Notes on Myiasis of the urinary Passage caused by Larvae of** *Fannia*.—*59th Ann. Rep. Ent. Soc. Ontario 1928*, pp. 57–59, 1 fig., 1 ref. Toronto, 1929.

A case of myiasis of the urinary passage in a child caused by numerous larvae of *Fannia canicularis*, L., in western Ontario is briefly discussed. The larvae are figured and described.

BARBER (M. A.). **The History of Malaria in the United States.**—*Publ. Hlth. Rep.*, xliv, no. 43, pp. 2575–2587, 13 refs. Washington, D.C., 25th October 1929.

Malaria, once very prevalent in the northern United States, has almost disappeared there, and is also less prevalent in the southern States, although its diminution has been less marked and has proceeded at a slower rate. The author gives accounts of the history of malaria prevalence in various parts of the United States, taken from his own experience and from the literature, and discusses the possible factors contributing to the decline of the disease in recent years. These factors are interdependent; their importance has varied with time and locality, but all have been closely related to the agricultural development of the country. The danger of a serious increase of malaria in the northern States is not great under the present economic conditions of the region, but in the South the likelihood of a recrudescence of the disease is much greater. The author considers that a further study of the history of the disease may afford useful data as to the best means of combating it.

Dolloff (A. F.). **The Use of Stearates (Calcium and Aluminum) as Diluents for Paris Green in Anopheles Control. A preliminary Report.**—*Publ. Hlth. Rep.*, xliv, no. 43, pp. 2588–2594. Washington, D.C., 25th October 1929.

Lime is slightly soluble and moderately heavy and does not therefore materially increase the capacity of Paris green to remain on the surface of water treated against Anopheline larvae. Experiments were therefore undertaken with calcium and aluminium stearates, which are highly insoluble and lighter substances, to determine whether, by keeping the larvicide on the surface for a longer period, they would delay the reappearance of the larvae and thus act as more efficient diluents. The details of the experiments are given in tables. Paris green mixed with lime was compared with mixtures of Paris green with calcium and aluminium stearates, and it was found that the stearates prolonged the period before the reappearance of the larvae from an average of 3 days to an average of 5–6 days. Experiments in which calcium stearate was substituted for 5–40 per cent. of the lime, showed that some of the mixtures, particularly that containing 10 per cent. calcium stearate, were more effective than those in which either lime or stearate alone was used as the diluent. Rain appeared to have no effect on the lethal period in an area treated with Paris green and calcium stearate. Microscopic examination of material taken from the surface of the water five days after application revealed particles of Paris green adhering to those of the stearate.

Lowry (P. R.). **Mosquitoes of New Hampshire. A preliminary Report.**—*Bull. New Hampshire Agric. Expt. Sta.*, no. 243, 23 pp., 1 pl. Durham, N.H., June 1929.

A list is given of the 38 species of mosquitos that occur in New Hampshire, with notes on their breeding-places. The common mosquito pests in any particular locality during a summer generally consist of not more than 5 or 6 species that vary from year to year according to local breeding conditions, climate, etc. In one of the coastal towns during 1928 five species occurred in sufficient numbers to be considered pests : *Aëdes communis*, DeG., and *A. excrucians*, Wlk., which occurred from the middle of May for about two months ; *A. vexans*, Mg., which began to appear about 1st June and was common up to about 25th July ; *A. cantator*, Coq., which was present from June to October ; and *A. sollicitans*, Wlk., which appeared about 11th June, increased in numbers until the middle of July, when it became the predominant species, and remained abundant until killed by the frost in October. Malaria is extremely rare in New Hampshire, but as persons that have contracted the disease elsewhere must occasionally enter the State, and as Anopheline mosquitos, including *Anopheles quadrimaculatus*, Say, are well distributed, there is the possibility that local outbreaks may occur.

A general account is given of the bionomics and control of mosquitos, most of the information on oiling and draining being taken from the work done in New Jersey. In 1928, no breeding was observed in permanent fresh water pools well stocked with nine-spined sticklebacks (*Pungitius pungitius*), but the temporary pools where fish did not occur gave rise to large numbers of *Aëdes vexans*. The most important natural enemy of the salt marsh mosquitos in New Hampshire is the

killifish (*Fundulus heteroclitus*), which is extremely abundant and follows the incoming tide anywhere on a marsh where there is sufficient water. Mosquitos can only breed successfully in isolated pools that are not reached by ordinary tides.

KING (W. V.). **On the Development of Malaria Parasites in the Mosquito.**—*Amer. J. Hyg.*, x, no. 3, pp. 560–564, 7 pls., 1 ref. Baltimore, Md., November 1929.

Descriptions are given of a series of 21 photomicrographs illustrating the sexual cycle of malaria parasites (*Plasmodium vivax* and *P. falciparum*) in the mosquito, the species used being *Anopheles quadrimaculatus*, Say, *A. punctipennis*, Say, and *A. crucians*, Wied. The time required for the development of the parasite in Anophelines is usually given as 9–10 days, but is subject to variation depending on the temperature to which the mosquitos are exposed. In the author's experiments, the shortest periods from the time of the blood meal to the invasion of the salivary glands with sporozoites were 12 days with malignant tertian at a mean room temperature of 79° F. and 14 days with benign tertian parasites at a mean temperature of 74°. There was little difference in the average length of life between infected and uninfected mosquitos, and no marked reduction in vitality in the more heavily infected individuals.

KING (W. V.). **Additional Notes on the Infection of *Anopheles* with Malaria Parasites.**—*Amer. J. Hyg.*, x, no. 3, pp. 565–579, 1 fig., 8 refs. Baltimore, Md., November 1929.

Field and laboratory investigations of malaria infection in mosquitos have been conducted in Louisiana at various times over a period of several years, and the results of various phases of the work have been published in brief reports [*R.A.E.*, B, iv, 53, 90, 152; v, 73; ix, 179]. This paper contains additional information of a more general nature. The adults of *Anopheles crucians*, Wied., used in the experiments were caught in the field, but those of *A. quadrimaculatus*, Say, and *A. punctipennis*, Say, were reared from larvae and fed only on raisins and water except for a single blood meal on a gametocyte carrier. Individual mosquitos were placed in a container consisting of a glass tube 1 in. in diameter and 4 ins. long, one end of which was covered with fine net and the other closed with a cork bored to hold a small vial 4–6 mm. in diameter containing water, with a strip of blotting paper as a wick from which the mosquitos could drink. A piece of blotting paper or light cardboard was fitted inside the tube for them to rest on. A bit of soft raisin was placed on the net at the top. It was found that mosquitos could be transported for 250 miles in these tubes; in this case two or three could be placed in one tube. On arrival they were isolated in separate tubes and kept at a temperature of 45–55° F. When the tubes were taken from the ice-box for the mosquitos to be given a blood meal, the water and raisins were removed so that no food was available as they became warm. The tubes were then placed with the cloth-covered end towards the light, and when the mosquitos settled on the cloth they were placed on the skin of the gametocyte carrier. A slight moistening of the skin usually helped to induce feeding. Care should be taken to prevent mould on the corks and cloths of the containers.

Ten out of twelve carriers of benign tertian malaria and five out of six carriers of malignant tertian proved infective to Anophelines, but as all were hospital cases, they probably showed a higher percentage of infective individuals than could be expected under ordinary conditions. Of the mosquitos fed on them, 51·2 per cent. gave positive results. Certain differences were noted in the percentage of infections between the three species of Anophelines and between the two species of *Plasmodium*, but in view of the variability of infectiveness among gametocyte carriers, these differences could not be taken as definitely significant. Little or no correlation was found between the numbers of gametocytes in the blood and the percentage of infections or the number of oöcysts produced in the mosquito. There was some uniformity, however, in the number of oöcysts occurring in different mosquitos of the same batch. Degeneration of the oöcysts occurred in some of the mosquitos after the parasites were well developed, but whether this was the result of artificial conditions or whether it also occurs in nature is not known.

A large number of infected mosquitos were taken in collections from negro houses, but few showed sporozoites in the glands. It therefore appears that infective mosquitos are no more likely to be found about the house from which infection originated than at any other place.

Barber (M. A.) & Komp (W. H. W.). **Breeding Places of *Anopheles* in the Yazoo-Mississippi Delta.**—*Publ. Hlth. Rep.*, xliv, no. 41, pp. 2457–2462. Washington, D.C., 11th October 1929.

An account is given of a mosquito survey of a district on the eastern edge of the plain between the Yazoo and Mississippi rivers. A table shows the numbers and species of Anopheline larvae and pupae collected in each month over a period of four years (1925–29), with the type of breeding-place in which they were found. *Anopheles quadrimaculatus*, Say, which is the most important vector of malaria in this region, was the most numerous species. Larvae, which were found occasionally in February and March, became more plentiful in April and from May to November were found in almost all types of breeding-place. This complicates the problem of anti-larval measures; though drainage might greatly reduce the available breeding-places, it is an expensive measure that can hardly be undertaken except as a means of reclaiming land. *A. punctipennis*, Say, is also common in this district, *A. crucians*, Wied., and *A. barberi*, Coq., being comparatively rare.

Boyd (M. F.) & Aris (F. W.). **A Malaria Survey of the Island of Jamaica, B.W.I.**—*Amer. J. Trop. Med.*, ix, no. 5, pp. 309–399, 2 pls., 13 figs., 36 tables, 10 maps, 20 refs. Baltimore, Md., September 1929.

Endemic malaria in Jamaica is mainly confined to the coastal plains, where several foci of high intensity may be distinguished in which malaria is frequent and common, surrounded by a larger irregular zone within which intensity is much less and transmission is irregular. The diminution of the intensity of transmission brought about by a series of years with subnormal precipitation is most noticeable in these zones. Little, if any, malaria appears to occur over the interior of the Island. It would seem that the intensity of malaria over the entire

Island has been declining for about the past 20 years, and that during the 20-year period preceding this decline its intensity was far greater, whereas 60 years ago the incidence of malaria was comparable to that at present existing. This cycle in malaria intensity coincides with a cyclical change in the precipitation. Malaria is generally intensified in years of moderately excessive rainfall and declines during those in which rainfall is subnormal, but excessive precipitation occurring late in the year does not result in an increase of malaria till the following year. This is due to the accumulation of temporary water, which affords increased opportunities for the breeding of the probable vector. The lowland areas where agriculture is most successful coincide with foci of intense malaria, the principal crops grown requiring much water, which is often supplied by irrigation. A large proportion of the labour is supplied by workers from the plateau, who usually suffer severely from the disease when living in the lowlands, and the extensive employment of reasonable control measures would be economically justifiable.

The Anophelines indigenous to Jamaica are *Anopheles albimanus*, Wied., *A. crucians*, Wied., *A. vestitipennis*, D. & K., and *A. grabhami*, Theo. A key to the adults and larvae is given. *A. albimanus* is regarded as the most dangerous on account of its wide distribution over the lowlands, its ability to breed in temporary water and the coincidence of its annual prevalence during the summer and autumn with the principal periods of malaria transmission. Moreover, it shows a distinct preference for human blood and has been proved to be susceptible to infection with malaria parasites. *A. crucians* and *A. vestitipennis*, though potential vectors, are relatively scarce and of limited distribution. Since *A. grabhami*, in addition to showing no preference for human blood, is more extensively distributed than the other species, and as its prevalence does not coincide with the principal periods of malaria transmission, it is unlikely to be a vector.

A. crucians and *A. vestitipennis* have only been found breeding in fresh waters, whereas both *A. albimanus* and *A. grabhami* breed in practically all types of water collections, including brackish water. In the case of permanent streams, *A. albimanus* is chiefly confined to the lowlands where the current is slow, whereas *A. grabhami* may be found along the margins of rapidly moving upland streams. *A. grabhami* and *A. vestitipennis* prefer shaded or cool waters, but *A. albimanus* and *A. crucians* show a preference for sunny situations. Most larvae were found among horizontal vegetation, excepting places covered with a dense mat of duckweed (*Lemna* sp.), which proved definitely unfavourable; vertical vegetation shading the water surface appears to offer a situation especially suitable to *A. vestitipennis*. A list of larvivorous fish found in Jamaica is quoted, including *Gambusia gracilior* and *Limia dominicensis*, which were collected during this survey. Precipitin tests to determine the source of the blood meal of freshly fed mosquitos taken in barracks in October and November showed that 50 per cent. of *A. albimanus* had fed on man and more individuals of *A. vestitipennis* had fed on man than on available animals. Experimental infections of Anophelines resulted in producing oöcysts with *Plasmodium vivax* and *P. falciparum* in *A. albimanus*, but owing to scarcity of material it was impossible to continue the experiment long enough to admit of sporozoite infection. The data secured by workers in other places in regard to the susceptibility of *A. albimanus* and *A. crucians* are briefly reviewed.

It is suggested that further surveys for the determination of the local distribution of *A. albimanus* and the most practical means for the abatement of actual or potential areas of production should be carried out, and that routine dusting of Paris green should be applied to the marshes in the neighbourhood of certain towns. With a view to dealing with the much more difficult and important question of control in rural areas, it is proposed to determine the relative merits of three plans of treatment : concentration of dwellings at the maximum distance from Anopheline production areas, combined with proper orientation of doors and windows to the prevailing winds and the study of mosquito-proof construction ; effecting the maximum improvements in drainage and irrigation ; and the frequent routine distribution of cheap larvicides alone, such as Paris green or waste oil.

Evans (A. M.). **Notes on certain Varieties of *Anopheles marshalli* Theobald.**—*Ann. Trop. Med. & Parasit.*, xxiii, no. 3, pp. 415–425, 6 figs., 9 refs. Liverpool, 8th November 1929.

Descriptions are given of the larva, pupa and male genitalia of *Anopheles marshalli* var. *moucheti*, Evans, and the pupa of *A. marshalli* var. *hargreavesi*, Evans, from the Belgian Congo, and of the pupa and male genitalia of *A. marshalli* var. *freetownensis*, Evans, from Sierra Leone.

Schüffner (W. A. P.), Korteweg (P. C.) & Swellengrebel (N. H.). **Experimental Malaria with protracted Incubation.**—*Proc. k. Akad. Wetensch.*, xxxii, no. 7, pp. 903–911, 1 fig., 18 refs. Amsterdam, 1929.

The authors demonstrated by experiments that, in Holland, one or two bites during autumn of *Anopheles maculipennis*, Mg., infected with benign tertian malaria (*Plasmodium vivax*) gave rise to a first onset of fever in the early summer of the following year. It was also found possible to cause the fever to appear within the usual time limits in autumn and winter, when heavily infected mosquitos were given an opportunity to feed a number of times. The evidence obtained suggests that the more important part of the annual malarial epidemic, which occurs before the second half of July, is due to infections acquired in the preceding autumn [*cf. R.A.E.*, B, xvii, 221].

Swellengrebel (N. H.). **La dissociation des fonctions sexuelles et nutritives (dissociation gono-trophique) d'*Anopheles maculipennis* comme cause du paludisme dans les Pays-Bas et ses rapports avec "l'infection domiciliaire."**—*Ann. Inst. Pasteur*, xliii, no. 10, pp. 1370–1389, 4 diagr., 2 pp. refs. Paris, October 1929.

Certain authors contend that malaria is a household disease [*R.A.E.*, B, xi, 200 ; xiv, 177, etc.], and that among Anophelines in houses there are infected individuals that remain sufficiently long to become infective. Others argue that mosquitos that become infected in a house will have departed long before the completion of the development of the *Plasmodium*, and that the chances of their re-entering a house at the time of the appearance of the sporozoites will be small where there are cow-sheds, since these are more attractive than human

habitations. They do not consider the house a centre of Anopheline infection and deny the utility of destroying domestic mosquitos [viii, 143; xii, 56; xvii, 250, etc.].

In Holland some regions are malarious, whereas others are free from the disease, although the area of stagnant waters in both is approximately the same [xv, 145; xvi, 142; xvii, 221, etc.]. Moreover, the annual outbreak of benign tertian malaria reaches its height when the Anopheline density is lowest, and precedes by three to five months the season of the maximum numbers of infected mosquitos. In malarious regions during the summer, Anophelines that become infected in a house are forced to leave it after 3 or 4 days (a period insufficient for the maturation of the parasites) in order to oviposit, and in rural districts where each farm has one or more cow-sheds the chances of infected mosquitos returning to houses to shelter are never more than one in 200. At the beginning of September egg production ceases entirely and the mosquitos remain in the shelters, whether houses or cow-sheds, where they happen to be at that time. They do not, however, cease to feed, and their appetite only decreases slowly during the following months. This "fixation" results in a considerable increase in the number of sheltering Anophelines, since adults emerging from pupae seek shelter but do not leave it for oviposition (the number of sheltering females reaches its maximum in September and October). Moreover, infected individuals no longer migrate to the cow-sheds, the oöcysts gradually reach maturity and the mosquito's need for nourishment assures the infection of man. Few cases of malaria appear to occur in infested houses, but it has been shown that persons bitten by infected mosquitos in the autumn contract the disease after an incubation period of six to nine months [see preceding paper], a fact that explains why the maximum number of malaria cases occurs in May and June long before the number of Anophelines increases to any great extent. The continuation of feeding after the cessation of oviposition is termed by the author "gonotrophic dissociation."

In the regions free from malaria, oviposition ceases, "fixation" takes place, and the number of Anophelines in houses from September to December (*i.e.*, during the malaria season among mosquitos) is sometimes as much as four to six times as great as in the malarious regions. Moreover, in the cow-sheds of the malaria-free region, there are only about 7 per cent. of the mosquitos in the cow-sheds in the malarious districts. The only difference is, therefore, in the degree of nourishment; the majority of the mosquitos in malaria-free regions evince no desire to feed on blood after reproductive activity ceases. This condition is termed "gonotrophic concordance." They do not, therefore, transmit malaria in the autumn. The difficulty of malaria transmission in the summer by either type of mosquito has been pointed out.

Morphologically the mosquitos of gonotrophic dissociation correspond to the small type of Anopheline with a larger number of maxillary teeth, and those of gonotrophic concordance to the larger type with a smaller number of maxillary teeth, the winter distribution of which has already been discussed [xvi, 242]. Thus it appears that the attraction exerted by cow-sheds practically prevents the transmission of malaria during the reproductive period, but that the autumnal transmission is only suppressed by gonotrophic concordance. This condition, which can only exist during the slowing down of all vital functions, is a mark of true hibernation. Gonotrophic dissociation, on the other hand,

occurs when hibernation is incomplete, and it is suggested that it may occur in warm countries, where hibernation does not take place, at any other period of sexual inactivity.

PITTALUGA (—), MARTINEZ CEPA (—), TORRIJOS (—) & GINES (—). **Estudios sobre el paludismo en Aragón. Estudio de la estanca de Alcañiz.** [Studies on Malaria in Aragon. The Lake of Alcañiz.] —*Med. Países cálidos*, ii, no. 3, pp. 225–250, 19 figs. Madrid, May 1929. (With a Summary in French.)

This lake, which is $3\frac{3}{4}$ miles in circumference, is full of vegetation, and *Anopheles maculipennis*, Mg., breeds in it in very large numbers. In spite of this, very little malaria occurs in the immediate neighbourhood. Though the mosquitos are more abundant in animal quarters than in houses, considerable numbers were found in the latter.

DE BUEN (E.). **Incompatibilidad de coexistencia entre larvas de *Anopheles* y *Lemna*.** [The Incompatibility of Occurrence together of *Anopheles* Larvae and *Lemna*.]—*Med. Países cálidos*, ii, no. 3, pp. 265–270, 1 fig., 12 refs. Madrid, May 1929. (With a Summary in French.)

Observations made in Spain in 1928 showed that *Lemna* occurs chiefly in waters containing organic matter. It developed vigorously in water in a tank polluted by rabbits, in which very few Anopheline larvae were found. After the tank had been cleaned, however, the water was soon swarming with larvae of *Anopheles maculipennis*, Mg. The cultivation of *Lemna* has not succeeded hitherto, unless the water is contaminated and unfit for domestic use.

PECORI (G.) & ESCALAR (G.). **Relazione sulla campagna anti-malarica dell'anno 1928.** [Report on the anti-malarial Campaign in 1928 in the Government District of Rome.]—*Riv. Malariol.*, viii, no. 5, pp. 481–533, 1 fig. Rome, 1929. (With Summaries in Italian, p. 629, French, p. 631, English, p. 633, German, p. 635.)

Anti-malarial work in 1928 was continued on the same lines as in the preceding two years [*R.A.E.*, B, xv, 182; xvi, 245]. The first males of *Anopheles maculipennis*, Mg., occurred very late (11th May), and larvae and pupae were found as late as 27th November. The late appearance of the males may possibly be due to the winter campaign against the adults. As usual, the maximum numbers of Anophelines at Ostia occurred in June, when over 11,000 out of a total of over 32,000 for the period January–December were taken. These numbers were much larger than in 1927, but the expected serious outbreak of malaria did not occur. Of 1,771 mosquitos dissected, 1,755 were *A. maculipennis* and 16 *A. bifurcatus*, L. Dissections showed 0·5 per cent. to be infected. Further observations indicate that stabled animals are a protection against the disease. A special type of pig-sty with a very smooth ceiling and a space between the ceiling and the roof that prevents excessive heating of the former appears to be attractive to the mosquitos.

Sepulcri (P.) & Vidale (E.). **Ibernamento dell'***Anopheles bifurcatus* **in provincia di Venezia.** [The Hibernation of *A. bifurcatus* in the Province of Venice.]—*Riv. Malariol.*, viii, no. 5, pp. 585–589, 2 figs. Rome, 1929. (With Summaries in Italian, p. 630, French, p. 632, English, p. 634, German, p. 636.)

An account is given of observations on the hibernation of the larvae of *Anopheles bifurcatus*, L., in the province of Venice. The winter is passed in the third and fourth instars, and the pupae do not hibernate. The author discusses the adaptation of the insect to this method of hibernation by natural selection. The larvae appear to be able to live for long periods below the surface of the water.

Falleroni (D.). **Discussione sulla zooprofilassi. Norme per le costruzioni rurali in zone malariche. Nota sesta.** [Discussion on Zooprophylaxis. Rules for rural Buildings in malarial Zones. Sixth Note.]—*Riv. Malariol.*, viii, no. 5, pp. 590–606, 6 figs. Rome, 1929. (With Summaries in Italian, p. 630, French, p. 632, English, p. 634, German, p. 636.)

The rules to be followed in erecting dwellings and animal quarters, in order that the latter may attract Anophelines and keep them away from the former, are discussed in detail and illustrated by plans. Chief attention must be paid to mosquitos coming from their breeding-places to feed.

Walravens (P.). **La malaria à Elisabethville. Conditions de la lutte contre la maladie.**—*Ann. Soc. belge Méd. trop.*, ix, no. 3, pp. 197–202, 1 fig. Brussels, 30th October 1929.

In the course of observations on the mosquitos of Elisabethville (Belgian Congo), the author includes, in addition to the species enumerated in a previous record [*R.A.E.*, B, xv, 103], *Anopheles pretoriensis*, Theo., *A. aureosquamiger*, Theo., *A. nili*, Theo., and *A. argenteolobatus*, Gough. The malaria vectors are *A. gambiae*, Giles (*costalis*, Theo.), which constitutes 89 per cent. of the Anopheline fauna, and *A. funestus*, Giles, and as the former is found in all parts of the town, anti-larval measures should be carried out everywhere.

Thomson (J. G.). **Endemic and epidemic Malaria in Southern Rhodesia.** —*Proc. R. Soc. Med.*, xxii, no. 8, pp. 1051–1058 (Sect. Epidem. & State Med., pp. 49–56), 2 charts, 9 refs. London, June 1929.

During the wet season from October to March, the mean maximum and minimum temperatures in Southern Rhodesia are above 80° and 60° F. respectively, so that conditions are ideal for the breeding of *Anopheles gambiae*, Giles, which is the chief vector of malaria. The high constant temperature is also favourable for the development in the mosquito of *Plasmodium falciparum*, which is responsible for about 95 per cent. of the cases of malaria. Adults of *A. gambiae* are found from the end of November to the beginning of June, when they are killed by the sudden drop in the temperature. The curve of

malarial incidence is at its height in March–May and shows a remarkable drop in June. The native children constitute the chief reservoir of infection for the mosquitos; in a single examination of 100 children under ten years of age, more than 40 showed gametocytes in their peripheral blood, whereas gametocytes are rarely found in adult natives, although they all harbour parasites.

The high incidence of *P. falciparum* and the hyperendemic conditions lead inevitably to attacks of blackwater fever in Europeans, unless care is taken to avoid repeated infections [*R.A.E.*, B, xiii, 61].

Anophelines can only be detected with difficulty in badly lit houses at night, but observations in Southern Rhodesia lead to the conclusion that malaria is contracted in houses, the occupants being usually bitten by mosquitos when asleep. The systematic destruction of adult Anophelines in houses might be a useful anti-malarial measure, but this would be difficult in the badly constructed houses of Southern Rhodesia. *A. gambiae* is a rural species, and it seldom occurs in the houses of the larger towns, which are consequently almost free from malaria. In the rural districts, the scattered nature of the farms renders the prevention of malaria a matter of great difficulty, but measures should be taken against the larvae of *A. gambiae* in the wet season. In this way, individual settlers, with the help of a malariologist, could effectively reduce the Anopheline density in the houses. Well-built and carefully screened houses and the rigid use of efficient mosquito nets constitute one of the best means of protection in rural districts.

In the discussion that followed, J. H. Moore pointed out that the destruction of adult mosquitos was quite inapplicable to the protection of a large labour force, for example on tea estates, in the tropics. He emphasised the necessity for the treatment of all children with euquinine or plasmochin at the approach of the malaria season, in order to reduce the infection of the early broods of Anophelines, and stated that by the oiling of mosquito breeding-places and the administration of euquinine to the children, the spleen-rate on certain groups of estates in his charge in Travancore had been lowered in five years from 70 per cent. to less than 10 per cent.

Strickland (C.), Choudhury (K. L.) & others. **A Report on a Mosquito-Malaria Survey of the Duars Tea Gardens.**—Med. 8vo, iv+145 pp., 3 figs., 13 refs. Calcutta, Indian Tea Assoc. [1929.]

The introduction to this report, by Strickland, contains a review of previous investigations on malaria in the Bengal Duars; the author contends that the improvement in the conditions of life of the labourers on the tea estates that has taken place in the last twenty years has not been accompanied by any reduction in malarial incidence, and that there is no proof that the social conditions of the coolies have had anything to do with the epidemiology of malaria.

The main part of the report, which deals with a survey made from April to July 1926, is occupied by a discussion of evidence regarding the species of Anophelines responsible for transmitting malaria in the district, and their relation to different types of terrain. The relative frequency of the larvae of the Anophelines found in the course of the survey has been noticed elsewhere [*R.A.E.*, B, xvi, 99]. The breeding-places of each species on the various estates are shown in a

table. The percentages of the adults captured were: *Anopheles subpictus*, Grassi (*rossi*, Giles) and *A. vagus*, Dön., together, 56·9; *A. funestus*, Giles (of which the authors consider *A. listoni*, List., and *A. minimus*, Theo., to be synonyms, stating that about 20 per cent. were of the *listoni* type and 80 per cent. of the *minimus* type), 23·9; *A. culicifacies*, Giles, 8·5; *A. fuliginosus*, Giles, 2·7; *A. maculipalpis*, Giles, 2·4; *A. jamesi*, Theo., 2·3; *A. maculatus*, Theo., 1·8; and *A. karwari*, James, and *A. hyrcanus* var. *sinensis*, Wied., 0·03 each. From the infectivity elsewhere of the various species with malaria, it is concluded that *A. funestus* (including both the *listoni* and *minimus* types) is the most important vector in the Duars, *A. culicifacies* coming next and *A. maculatus* third.

Physiographically, the Duars comprise three main zones, each with streams of all degrees of size and permanency, although there is least surface water in the middle zone. *A. maculatus* is found where the fluctuations in the amount of surface water are most considerable, *viz.*, in the medium-sized streams of the highest zone. *A. funestus* breeds principally in the perennial streams of the lowest zone, and *A. culicifacies* in the pools in the river beds, before and after the rains, in the middle zone. However, with the exception of *A. maculatus*, which is commoner under the foothills, the distribution of the species in wide tracts is a fairly random one, although *A. funestus* probably breeds more often in grass-edged streams and *A. culicifacies* in pools in old river beds.

The recommendations are largely on the lines of those in another report [xvi, 245], to which the authors refer the reader for fuller details. The measures against mosquito larvae, designed to control the particular species that transmit malaria, include clearing the edges of medium-sized streams, covering small ones with jungle growth, oiling pools in river beds and draining swamps and seepage water.

In a note by S. Kingsley-Ward on Anophelines breeding in grass-grown roadside borrow-pits, it is stated that none of the species found in these was known to be dangerous as a vector of malaria.

Some notes on the use of two types of traps for catching mosquitos in habitations and cow-sheds are given in an appendix. There is some indication that a tea-box trap is more effective in catching the species of Anophelines that carry malaria than is a basket, covered in cow-dung, having a lid with a hole in the centre six inches in diameter.

GATER (B. A. R.) & RAJAMONEY (P. D.). **Notes on handling *A. maculatus* Theo. for experimental Purposes.** -*Malayan Med. J.*, iv, no. 3, pp. 88–91, 6 refs. Singapore, September 1929.

The author describes attempts to prolong the adult life of *Anopheles maculatus*, Theo., in the laboratory for experimental purposes. Evidence has shown that humidity is an important factor in keeping mosquitos, and as in Malaya the humidity drops considerably (to an average of 65 per cent.) during the afternoon, it was decided to test the longevity of adults kept continuously at this relative humidity. It was found that those fed on moist raisins only lived for 4·2 days, while those given a blood meal in addition, shortly after emergence, survived for an average of 6·9 days. Females kept in lamp-globe cages placed on their sides and containing a piece of cotton-wool saturated

with water and a dry twig for the mosquito to rest on, survived for an average of 23·7 days, and for 26·8 days when provided with a blood meal. The method of feeding is described.

WALLACE (R. B.). **Reduction in Oiling at certain Seasons.**—*Malayan Med. J.*, iv, no. 3, pp. 92–95. Singapore, September 1929.

An attempt was made to reduce the high anti-malarial expenditure on certain estates in Malaya by reducing the amount of oiling at seasons when the malarial incidence is not high. As a result of reducing the oiling radius from ½ to ¼ mile, there was some increase in the numbers of larvae of *Anopheles maculatus*, Theo., found in the half-mile area, and a slight increase in the number of adults in some quarters, but there was no increase in the malaria rate and a considerable saving in anti-malarial expenditure was effected.

GRAHAM (D. H.). **Mosquitoes of the Auckland District.**—*Trans. N.Z. Inst.*, lx, pt. 2, pp. 205–244, 75 figs., 9 refs. Wellington, N.Z., 31st August 1929.

An account is given of the bionomics of *Aëdes* (*Finlaya*) *notoscriptus*, Skuse, *Culex pervigilans*, Bergr., and *Rachionotomyia argyropus*, Wlk., the three mosquitos that commonly attack man in the City of Auckland and its environs. All stages are described, with keys.

SCHWARZ (L.). **Bekämpfung der Gesundheitsschädlinge durch Blausäure.** [The Control of Pests injurious to Health by Hydrocyanic Acid Gas.]—*Z. Desinfekt.*, xxi, no. 1, pp. 1–13, 5 figs., 38 refs. Dresden, January 1929.

This is a survey of the use of hydrocyanic acid gas against insects and other pests injurious to health, most of the references being from Germany. Tables show the various dosages required, and the absorption and release of the gas by various cements and stones used in the construction of buildings.

BUCHMANN (W.). **Weitere Untersuchungen über die Wirkung von Pyrethrumpulvern auf die Muscidenbrut.** [Further Investigations on the Effect of Pyrethrum Powders on the Larvae of Muscids.]—*Z. Desinfekt.*, xxi, nos. 1–2, pp. 14–16, 37–39, 3 refs. Dresden, January–February 1929.

Experiments showed that the larvae of *Stomoxys calcitrans*, L., and *Musca domestica*, L., are killed by pyrethrum powder mixed at the rate of from 1 : 320 to 1 : 500 with stable manure.

PIETRUSKY (F.) & LEO (A.). **Aasfresser und ihre gerichtsärztliche Bedeutung.** [The Animals attacking dead Bodies and their medico-legal Importance.]—*Z. Desinfekt.*, xxi, nos. 1–2, pp. 16–18, 40–51, 1 fig., 57 refs. Dresden, January–February 1929.

This is a survey of the literature on the insects and other animals that attack dead bodies, with particular reference to the medico-legal aspects of the question [*cf. R.A.E.*, B, ix, 121].

NEUMARK (E.) & HAPPE (H.). **Bericht über die Ergebnisse der Mückenbekämpfung in Berlin 1927-28.** [Report on the Results of Mosquito Control Work in Berlin in 1927–28.]—*Z. Desinfekt.*, xxi, no. 6, pp. 145–148, 1 ref. Dresden, June 1929.

In the winter of 1927-28 work against mosquitos in Berlin was carried out in 51,000 houses out of a total of 98,000 at a cost of £8,000. Various proprietary dust insecticides were usually employed, but sprays were applied in damp cellars. The results were satisfactory. A summer campaign against the larvae was conducted in 1928, but only on a limited scale, as mosquitos were comparatively rare owing to the dry summer.

KEMPER (H.). **Der "Parevo"-Apparat, ein neues Hilfsmittel in der Wanzenbekämpfung.** [The "Parevo" Apparatus, a new Aid in combating Bugs.]—*Z. Desinfekt.*, xxi, no. 7, pp. 172–174. Dresden, July 1929.

This portable apparatus consists of a boiler of about 1½ gals. capacity, which can be heated in various ways. The steam, at 2 atmospheres pressure, is led through a flexible tube, at the end of which is a hand grip in which it is superheated electrically to 300° C. [572° F.]. Various nozzles can be fitted to enable the jet of steam to be directed into cracks, etc. Bugs [*Cimex lectularius*, L.] and their eggs are quickly destroyed. The superheated steam does not injure polished or glued articles provided that the nozzle is held at a distance of 1¼ ins.

SMORODINZEW (I. A.), ADOWA (A. N.) & RAVITSCH-SCHTSCHERBO (M. I.). **Die physiko-chemische Charakteristik der Torfsumpfgewässer in Bezug auf *Anopheles*-Brutstätten.** [The physico-chemical Characters of Peat-bog Waters as regards Breeding-places of *Anopheles*.]—*Z. Desinfekt.*, xxi, no. 8, pp. 193–197, 4 figs. Dresden, August 1929.

This is a brief review of the physico-chemical factors that influence the breeding of *Anopheles* [*maculipennis*, Mg.] in peat-bogs in Russia [*R.A.E.*, B, xvii, 65, etc.]. Under otherwise equal conditions it is preferable to cut sphagnum bogs instead of sedge bogs, in order to avoid the formation of new breeding-places.

KEMPER (H.). **Ein neuer Vergasungsapparat zur Schwefeldioxyderzeugung.** [A new Gas Generator for producing Sulphur Dioxide.]—*Z. Desinfekt.*, xxi, no. 12, pp. 301-302, 1 fig. Dresden, December 1929.

A portable generator is described in which carbon bisulphide is burned so as to produce sulphur dioxide with the minimum risk of fire.

SCHWETZ (J.). **Notes sur les trypanosomiases animales de Stanleyville (Etude préliminaire).**—*Bull. agric. Congo belge*, xix, no. 4, pp. 562-576. Brussels, December 1928.

The increase in the European population of Stanleyville led to the introduction of cattle in an attempt to establish farms, but trypanosomiasis is very prevalent and an investigation of the tsetse-flies and

trypanosomes in this region was therefore undertaken. In the town and its immediate environs flies are rare, though individuals of both *Glossina palpalis*, R.-D., and *G. fusca*, Wlk., have been taken. Further out small numbers of both species have been obtained, but whereas *G. palpalis* is only found along water courses and in wooded swamps, *G. fusca* seems to be less rare and exists more or less throughout the forest, a fact which suggests that this species is probably the local vector of trypanosomiasis.

Although a certain number of infected cases were found among cattle that had been in Stanleyville three or more years, the proportion was particularly high among cattle that had recently arrived from Kivu or Ituri, although they were uninfected at the time of departure. They must, therefore, have become infected on the way, and the distribution of tsetse-flies on the cattle routes is briefly discussed. Examinations showed that the trypanosomes in both cattle and sheep belonged to the *Trypanosoma vivax* and *T. congolense* groups; in one case a pig was found infected with *T. congolense*.

VANDERYST (H.). **Les Tabanidés hémophages au Congo belge.**—*Bull. agric. Congo belge*, xix, no. 4, pp. 608–630, 4 figs., 7 refs. Brussels, December 1928.

A somewhat popular account is given of the morphology and bionomics of Tabanids in general, with notes on the principal blood-sucking genera occurring in the Belgian Congo, and a key for their identification. It has been suggested that species of the genus *Tabanus* are sometimes concerned in the mechanical transmission of trypanosomiasis and anthrax. *Haematopota* spp. are extremely troublesome to man and animals in the western Congo on account of their numbers. *Chrysops dimidiata*, Wulp, is a vector of *Filaria loa* and is suspected of occasionally transmitting sleeping sickness mechanically.

SWYNNERTON (C. F. M.). **Annual Report of the Tsetse Reclamation Sub-Department Tanganyika Territory for the Year ended 31st March, 1929.**—Med. 8vo, 10 pp. Dar-es-Salaam, Govt. Printer [1929]. Price, 1*s.* 6*d.*

A great proportion of the remaining part of Tanganyika Territory that is at present free from *Glossina* appears to be threatened sooner or later by serious advances of the fly. The organisation and work of the reclamation sub-department is outlined, and details are given of the tsetse-fly situation in various districts in 1927 and 1928. It has been found possible to obtain the co-operation of the natives in Mwanza and Tabora, and the tsetse campaign is becoming an annual tribal custom. Moreover, the natives are settling in the areas cleared by the axe or by grass fires and using them fully for the grazing of large numbers of cattle [*cf. R.A.E.*, B, xiii, 105]. With regard to late organised grass fires, it has been found that after five burnings they produce a marked cumulative effect in some places. Not only are breeding thickets and logs being destroyed, but also much of the acacia woodland itself; dead trees are abundant and open spaces are appearing. In the more resistant bush young growth tends to be confined to one year's shoots, so that it seems likely that the woodland will die out with the death of the trees now existing. Evidence of the destructive effect of the fires on the pupae of *Glossina morsitans*, Westw., as well as on those

of *G. swynnertoni*, Aust., has now been obtained. There is much indirect evidence that an uninterrupted fierce fire drives the adult flies before it, but that they tend to return. As the result of fires a total of about 60 square miles has been cleared of flies, and fires with a small amount of bush clearing have been responsible for the clearing of a further 17 square miles. This land is still under bush but is now being grazed by cattle. The numbers of flies appear to be reduced in other areas, but they return at least in small numbers or hide in undestroyed refuges during the burning. The general results are considered sufficiently promising to warrant considerable expenditure on the development of this measure.

Until recently the only barrier against invasion or against the return of flies when driven out by burning was cleared, open country that game and man (and with them flies) can cross at any point. Recently, however, a dense continuous thicket 70–80 miles long that is unattractive to *G. morsitans* and excludes man and most game except on elephant paths has been found to act as a very effective barrier except at gaps in the north. During 1928 a game fence 14 miles long consisting of a palisade of " live " poles of *Commiphora* was erected ; these have sprouted successfully and the fence has so far proved effective, though smaller animals pass through, and it remains to be seen whether it will be worth while preventing them.

In Shinyanga, where over 64 square miles of clearing are actually being grazed, it is hoped to add another 150 square miles to the grazing reclaimed by the end of the current year's work. Considerable areas have also been cleared during 1928 in other districts, and the advance of the fly has been arrested in several localities.

SWYNNERTON (C. F. M.). **Annual Report of the Tsetse Research Department Tanganyika Territory for the Year ended 31st March, 1929.**—Med. 8vo, 18 pp. Dar-es-Salaam, Govt. Printer [1929]. Price, 2*s.* 6*d.*

An account is given of the organisation of the Tsetse Research Sub-Department in Tanganyika Territory for the investigation of the tsetse-fly problem from an ecological point of view. Preliminary reconnaissances were carried out and various research stations were established. Details are given of the particular investigations to be undertaken at each centre and the methods to be used. In cases where the work has already been begun, the results or indications obtained are discussed.

With regard to fly density, activity, breeding and general behaviour in relation to season, weather conditions, vegetation, game, and man, observations appear to indicate the existence of communities of *Glossina morsitans*, Westw., consistently showing an appreciably higher proportion of females than the general fly population in the surrounding country. These centres seem to be correlated with places particularly suitable for big game, such as water holes, grazing or stamping grounds and points of convergence within a reticulation of paths. At the end of the rains (late May), there is so marked an emergence of young flies as to increase appreciably the total catch. During the coldest months in the year (July–August), there is a definite decrease in the total catch in spite of the continued increase of newly emerged flies. Subsequently the numbers captured increase up to a certain point and remain relatively constant until shortly after the September grass-

burning, when they decrease steadily to a very low figure. At the end of the early rains (December), the numbers increase again to a figure equivalent to that obtained during the latter part of the long rains (April-May).

With regard to the general relations of *G. morsitans* and game, it was found that in a locality where the fly is relatively uniformly dense and where the movement of game is regulated almost entirely by the amount of water available in certain water-holes, only game movements on a very large scale appear to have any influence on the distribution and density of the fly. It was also noted that *G. morsitans* appears to prefer particular species of game. In studying the alteration of environmental factors as a measure of control, experiments are being carried out on the poisoning of trees with arsenic pentoxide in order to compare the efficiency and cost of this method and of felling, ring-barking, etc. As regards the direct and indirect influence of fire, it is reported that the September fires in one locality did no apparent damage to the fly population, which was only temporarily displaced by it, but appreciable numbers of pupae were destroyed.

Thyridanthrax abruptus, Lw., was the only parasite found in the puparia of *G. morsitans*, parasitism reaching about 11 per cent. in collections made over a period of six months.

Innes (F. A.). [**Notes on Insects and Disease.**]—*Ann. Med. Sanit. Rep. Gambia 1928*, pp. 11, 20. London, 1929.

Five cases of yellow fever occurred in Gambia in 1928 and others were suspected. Four cases were associated with trading premises badly infested with *Aëdes argenteus*, Poir.; these were subsequently fumigated with sulphur. In Bathurst there are two proved and two probable vectors of the disease, *A. argenteus*, *A. luteocephalus*, Newst., *A. irritans*, Theo., and *A. vittatus*, Big. [both *A. luteocephalus* and *A. vittatus* are experimental vectors (*R.A.E.*, B, xvi, 236; xvii, 213)], but *A. argenteus* is by far the most common mosquito in the town and presumably the only carrier of the disease there. A larva taken from a leper's sore was reared in the laboratory and determined as *Chrysomyia bezziana*, Villen. [*cf.* xvii, 99].

Colas-Belcour (J.). **Sur l'identité d'***Ornithodorus erraticus* **Lucas et d'***Ornithodorus marocanus* **Vélu.**—*C.R. Acad. Sci. Fr.*, clxxxix, no. 27, pp. 1316–1318, 4 refs. Paris, 1929.

As the result of a detailed comparison of specimens from several localities, the author concludes that *Ornithodorus marocanus*, Vélu, from Morocco, Spain and Algeria, is identical with *O. erraticus*, Lucas, from Morocco, Algeria, Tunisia and Egypt, the latter name having priority.

Nicolle (C.), Anderson (C.) & Colas-Belcour (J.). **Rôle d'***Ornithodorus erraticus* **dans la transmission naturelle de deux spirochètes récurrents. Danger de la propagation de la fièvre récurrente hispano-marocaine à l'Algérie et à la Tunisie.**—*C.R. Acad. Sci. Fr.*, clxxxix, no. 27, pp. 1220–1221, 2 refs. Paris, 1929.

The discovery that *Ornithodorus marocanus*, Vélu, is identical with *O. erraticus*, Lucas [see preceding paper] provides an instance in

nature of a single species of *Ornithodorus* being the vector of two groups of spirochaetes, since this tick transmits the group of *Spirochaeta hispanica* in Morocco and *S. normandi* var. *carthaginiensis* (*erratici*) in Tunisia.

There is a very large area from which *O. erraticus* has been reported, including the whole of Algeria, between the districts of Morocco in which *S. hispanica* is known to occur and Tunisia, and it would be interesting to determine the eastern limit of *S. hispanica* and the western limit of *S. normandi* in this area. The danger of the spread of *S. hispanica* to Algeria and Tunisia is discussed.

Zeiss (H.). **Die Pest in Russland. I. Pestähnliche Lymphdrüsenentzündungen im Wolgadelta 1926 (Tularämie ?).** [Plague in Russia. I. Plague-like Adenitis in the Volga Delta (Tularaemia?).] **II. Die pestähnlichen Seuchen an der Oka und dem Ural im Jahre 1928. Tularämie ?** [II. Plague-like Epidemics on the Oka and in the Ural in 1928. Tularaemia ?]—*Münch. med. Wschr.*, lxxvi, no. 27, pp. 1137–1138, 6 refs., no. 32, pp. 1342–1344, 1 fig., 1 ref.

Sarchi (G.). **Die Pest in Russland. Zu obigem Artikel von Prof. Dr. H. Zeiss in Nr. 27 u. 32, 1929, dieser Wschr.** [Plague in Russia. An Addition to the above papers.]—*T.c.*, no. 33, p. 1382. Munich, 1929.

The first two papers describe a disease in man resembling tularaemia in the Volga Delta, on a tributary of the Volga, and in the Ural. Water-rats, *Arvicola amphibius*, harbour the infection and are heavily infested by ectoparasites, including lice, fleas and ticks. The note by Sarchi states that comparison has proved the identity of the causal organism with the American *Bacterium tularense*.

Papers noticed by Title only.

Enderlein (G.). **Neue Arten des Simuliidengenus** *Cnetha* **(Dipt.).** [New European Species of *Simulium* (*Cnetha*).]—*Wien. ent. Ztg.*, xlvi, no. 2, pp. 73–78. Vienna, 15th September 1929.

Kroeber (O.). **Neue Dipteren aus Aegypten aus den Familien Tabanidae, Therevidae, Omphralidae u. Conopidae.**—*Bull. Soc. roy. ent. Egypte*, 1929, fasc. 1–3, pp. 73–84, 4 figs. Cairo, 1929.

Enderlein (G.). **Zur Kenntnis einiger von Herrn Oskar Schoenemann gesammelten chilenischen Melpiinen (Dipt.).** [Some Chilean Melpiinae (Tabanidae) collected by O. Schoenemann.]—*Wien. ent. Ztg.*, xlvi, no. 2, pp. 66–71. Vienna, 15th September 1929.

[King (H. H.).] **Tsetse Fly.** [*Glossina morsitans* in the Koalib Hills, Sudan.]—*Bull. Wellcome Trop. Res. Lab.*, Ent. Sect. no. 25, p. 5. Khartoum, January 1928. [*Cf. R.A.E.*, B, xvii, 59.]

Cazanove (F.). **L'épidémiologie de la peste au Sénégal.**—*Rev. prat. Maladies Pays chauds*, ix, no. 6, pp. 266–282, 2 maps. Alexandria, June 1929. [*Cf. R.A.E.*, B, xvii, 202, 256.]

Evans (A. M.). **Descriptions of the early Stages of two further Mosquitos collected in Southern Nigeria by Mr. L. H. Dunn.**—*Ann. Trop. Med. Parasit.*, xxiii, no. 3, pp. 407–413, 2 figs., 6 refs. Liverpool, 8th November 1929.

Selwyn-Clarke (P. S.). **Report on the Yellow Fever Conference at Dakar, 1928.**—Fol., 38 pp., 9 pls. Accra, Govt. Ptg. Off., & London, Cr. Agents Colon., 1929. Price, 2*s*. [*Cf. R.A.E.*, B, xvii, 109.]

Hill (R. B.). **El paludismo en Venezuela.** [Malaria and Mosquitos in Venezuela.]—*Gac. med. Caracas*, xxxv, no. 23, pp. 353–359, 3 refs. Caracas, 15th December 1928. [*Cf. R.A.E.*, B, xvii, 15, 108.]

La Face (L.). **Morfologia delle larve anofeliche e descrizione delle specie italiane.** [Morphology of Anopheline Larvae and Descriptions of the Larvae of the Italian Species.]—*Riv. Malariol.*, viii, no, 5, pp. 538–568, 7 figs., 12 pls., 23 refs. Rome, 1929. (With Summaries in Italian, p. 630, French, p. 632, English, p. 634, German, p. 636.)

Pannewitz (E.). **Systematik und Methodik der Schädlingsbekämpfungsmittel, unter besonderer Berücksichtigung der Patentliteratur.** [A Survey of Materials used against Pests, with particular Regard to Patent Specifications.]—*Z. Desinfekt.*, xxi, nos. 1, 6, 7, 9–12, pp. 18–21, 156–158, 174–178, 216–222, 248–252, 271–272, 297–300, 12 refs. Dresden, January, June, July, September–December 1929. [See *R.A.E.*, A, xviii, 93.]

Kemper (H.). **Die von der Preussischen Landesanstalt für Wasser-, Boden- und Lufthygiene geprüften und als geeignet befundenen Spritzmittel zur Bekämpfung der Gesundheitsschädlinge.** [Proprietary Sprays for Insects injurious to Health tested and approved by the Prussian State Institute for Water, Soil and Air Hygiene.]—*Z. Desinfekt.*, xxi, no. 6, pp. 158–163. Dresden, June 1929.

Buchmann (W.). **Die von der Preussischen Landesanstalt für Wasser-, Boden- und Lufthygiene geprüften und als geeignet befundenen Pyrethrum-Insektenpulver zur Bekämpfung der Gesundheitsschädlinge.** [The Proprietary Pyrethrum Insecticides for Insects injurious to Health tested and approved by the Prussian State Institute for Water, Soil and Air Hygiene.]—*Z. Desinfekt.*, xxi, no. 9, pp. 213–216. Dresden, September 1929.

Peus (F.). **Beiträge zur Faunistik und Oekologie der einheimischen Culiciden.** [Contributions to the Distribution and Ecology of German Mosquitos.]—*Z. Desinfekt.*, xxi, nos. 3–4, pp. 76–81, 92–98, 1 pl., 24 refs. Dresden, March–April 1929.

Buchmann (W.). **Untersuchungen über die Ernährungsphysiologie der Dipterenlarven. Teil I. Histophysiologie der Sekretion.** [Investigations on the Physiology of Nutrition of Dipterous Larvae. Part I. Histophysiology of Secretion.]—*Z. Desinfekt.*, xxi, no. 10, pp. 237–246, 1 fig., 1 pl., 11 refs. Dresden, October 1929.

Kemper (H.). **Untersuchungen über die Sinnesorgane und die Sinnesphysiologie der Bettwanze.** [Investigations on the Sense Organs and Sense Physiology of *Cimex lectularius*, L.]—*Z. Desinfekt.*, xxi, no. 12, pp. 285–297, 1 fig., 24 refs. Dresden, December 1929.

Schulze (P.) & Schlottke (E.). **Kleinhöhlenbewohnende deutsche Zecken mit Beschreibung dreier neuer Baumhöhlenbrüter und einer Bestimmungstabelle deutschen *Ixodes*. Erste Mitteilung.** [German Ticks inhabiting small Cavities, with a Description of three new Species occurring in Tree-holes and a Key to the German Species of *Ixodes*. I.]—*Sitz Ber. Abh. naturf. Ges. Rost.* (3) ii, pp. 95–110, 2 pls. Rostock, 1929.

Ewing (H. E.). **Four new Species of Chiggers (Acarina-Trombidiidae)** [from U.S.A.].—*Ent. News*, xl, no. 9, pp. 294–297. Philadelphia, Pa., November 1929.

[Ioff (I.).] **Иофф (И.). The Collection of Fleas from the Nests of Rodents.** [*In Russian.*]—*Laboratornaya Praktika*, 1929, no. 5, pp. 5–7, 4 figs. Leningrad, 1929.

The apparatus described consists of an iron box divided into two well-fitting halves, the upper part being covered with a lid and having a wire gauze bottom of 1 cm. mesh. The nest is placed in the upper half, and the box is covered with the lid and shaken, so that the fleas, with other small insects and siftings, fall through the gauze into the lower half. The sifted material is then placed on narrow shelves of a small bottomless wooden cupboard, which has an apparatus for heating it. When the heat is applied, the fleas jump from the shelves and fall into a metal basin placed under the cupboard.

Wu Lien-Teh, Pollitzer (R.), Lin Chia-Swee & Jettmar (H. M.). **Studies upon the Plague Situation in North China.**—*Nat. Med. J. China*, xv, no. 3, pp. 273–402, 10 pls., 2 pp. refs. Shanghai, June 1929.

A brief account is given of the history of plague in north-east Asia, and an outbreak of bubonic plague in the Tungliao region of Manchuria in 1928 is discussed in great detail. The local species of rat, *Mus* (*Epimys*) *norvegicus*, was found to be infected; the only two ecto-parasites observed on it were *Neopsylla bidentatiformis*, Wagn. (a hamster flea) and *Xenopsylla cheopis*, Roths. As experiments with individuals of *Pulex irritans*, L., and *Cimex lectularius*, L., taken from the clothes and blankets of plague victims and inoculated into guineapigs gave positive results, it seems probable that, in addition to *X. cheopis*, parasites of man, especially fleas, played a part in the dissemination of the disease. The various wild rodents of the district and their parasites are discussed. The Tungliao sand hamster (*Cricetulus* sp.) proved very susceptible to plague infection. No plague bacilli were found in mites infesting these animals, and inoculation of mites from infected hamsters into healthy animals gave negative results. Of 20 individuals of *Neopsylla bidentatiformis* that had had access to infected hamsters, 6 contained typical plague bacilli in the stomach and intestine, but the stomodaeum and proventriculus were empty and contracted; the other 14 fleas were uninfected. These investigations show that plague bacilli, when introduced into the stomach of this species, multiply very rapidly but do not block the proventriculus. An emulsion of fleas that had been kept in a starved condition at low temperatures (sometimes below freezing point) for 44 days after feeding on an infected hamster was inoculated into a healthy guineapig, which died of plague 7 days later. Living fleas and mites of hamsters were kept alive in nests without feeding for more than two months, and larvae of fleas were able to live for months in captivity in the nest during the winter without feeding.

Poisson (H.). **Prodrome d'études de parasitologie malgache (catalogue des collections recueillies et classées en 1926 et 1927; intérêt des études et collections parasitologiques).**—*Bull. écon. Madagascar*, Partie Document., xxiv, no. 1, pp. 133–144, 1 ref. Antananarivo, 1927. [Received 1929.]

A list is given of parasites of animals found in Madagascar, including the ticks, *Ornithodorus moubata*, Murr., *Aponomma exornatum*, Koch,

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Amblyomma variegatum, F., which transmits heartwater in sheep, *A. petersi*, Karsch, *Boophilus annulatus decoloratus*, Koch, transmitting bovine piroplasmosis, *Rhipicephalus sanguineus*, Latr., *Ixodes lunatus*, Neum., and *Haemaphysalis simplex*, Neum.

Demodex phylloides, Csokor, is recorded from a pig and *Linguatula serrata*, Fröl., from a dog.

[Olenev (N. O.).] **Оленев (H. O.). The Study of the Ixodoidea of our Country.** [*In Russian.*] — *Vestn. sovrem. Veter.*, v, no. 7–8 (80–81), pp. 191–193. Moscow, April 1929.

This is a brief review of the work carried out on ticks in the Russian Union in the course of the last hundred years. A list of the species recorded is appended, with notes on their distribution.

Quarantine Proclamation, no. 195.—*Commonw. Australia Gaz.*, no. 104, reprint 2 pp. Melbourne, 7th November 1929.

This Proclamation, dated 1st November 1929, supersedes previous ones so as to consolidate all the restrictions dealing with the importation of animals into Australia. Cattle may only be imported from the British Isles, New Zealand, Canada and the United States. Except from New Zealand, they can only be exported during December–May as a precaution against *Hypoderma bovis*, DeG., and those exported in May are subject to quarantine. In the case of cattle from the United States, a certificate is also required that they have never been on farms on which any cattle tick is known to exist. No insects may be imported, except for experimental purposes or for use in combating animal or plant diseases, pests or noxious insects, and with the approval of the Minister for Health.

Peter (—). **Immunisierung des Rindes gegen die Dasselfliegenlarven. Eine theoritische Betrachtung.** [Immunisation of Cattle against the Larvae of the Ox Warble Fly. A theoretical Consideration.] —*Berl. tierärztl. Wschr.*, 29th March 1929, p. 209. (Abstract in *Bull. Inst. Pasteur*, xxvii, no 21, p. 983. Paris, 15th November 1929.)

The fact that adult cattle in herds that have been subject to attack by *Hypoderma* remain uninfested, although larvae appear under the hides of young ones 8 or 9 months after attack, has hitherto been attributed to selection on the part of the flies, and to the greater ease with which the larvae can penetrate the less tough hides of the younger animals. Since numerous exceptions were found to exist to the immunity of the adults, it is suggested that the resistance is specific. This theory has been substantiated by the results of experiments in which eosinophilia was produced by the injection of an extract of the larvae under the hide of an ox, and cells of the same group were found in an infiltration from the oesophagus after larvae had passed through it. Examinations of the blood of animals bearing larvae showed the presence of antibodies (precipitins). These data suggest that the injection of blood or serum from adult animals that have harboured larvae would protect other animals against attack by the fly; active immunisation might also be secured by the injection of extracts of larvae.

Goffinet (L.). **Sur la gale chorioptique du cheval.**—*Ann. Méd. vét.*, lxxiv, no. 10, pp. 407–415. Brussels, October 1929.

In Belgium chorioptic or symbiotic mange of horses is relatively common, but owing to the secondary lesions caused by rubbing, etc., is often wrongly diagnosed. It is generally benign and only slightly contagious, but may cause blemishes that lower the value of infested animals. Sarcoptic, psoroptic and symbiotic manges are briefly differentiated, the latter being largely confined to the lower part of the legs. The causal agent is a Sarcoptid mite [*Chorioptes equi*, Gerl.], which is described. One female lays 15–20 eggs a few days after pairing, and the life-cycle lasts a fortnight. The mite is disseminated by infested litter or grooming implements. Infestation generally begins in the fold of the pastern or on the fetlock joint, usually on the hind legs, and owing to the gregarious habits of the mites only spreads slowly. The irritation set up causes the horses to paw the ground and in attempting to bite the affected parts, they sometimes slip and sustain strains or fractures. On the other hand mange may exist for years without causing serious discomfort. The symptoms are remittent, for the mites that in summer find abundant nourishment in the cutaneous secretions are forced during the winter to feed on the skin itself. Infested horses need not be isolated, owing to the slight risk of contagion, but stables and grooming implements should be carefully disinfected and the animals' legs kept clean. Two applications of Helmerich's ointment at an interval of ten days is recommended. The crusts may be removed with hot solutions of sodium carbonate, or, if this is not effective, with 10 per cent. salicylic acid ointment. Repeated washing with a 2 per cent. emulsion of cresyl may be employed when it is desirable to preserve the hair on the infested regions.

Navarro de Andrade (E.). **Pesquisas sobre o berne.** [Investigations on Infestations by the Larva of *Dermatobia hominis*.]—*Arch. Inst. biol.*, ii, pp. 53–60. S. Paulo, 1929. (With a Summary in English.)

Much of this information on *Dermatobia hominis*, Say, infesting animals in S. Paulo has been noticed from an earlier paper [*R.A.E.*, B, xvii, 53]. In 1929, in the absence of cattle, the percentage of infestation in equines was less than half that observed in 1927.

Fischer (C. R.). **Notas biologicas sobre o *Crabro tabanicida* Fischer 1929 e considerações concernentes ás motucas.** [Biological Notes on *C. tabanicida* and some Considerations on Tabanids.]—*Arch. Inst. biol.*, ii, pp. 141–163, 3 pls., 47 refs. S. Paulo, 1929. (With a Summary in English.)

Notes are given on the bionomics of the Sphegid, *Crabro tabanicida*, Fischer [*R.A.E.*, B, xvii, 227] in Brazil. Of the Tabanids found in its nests about 66 per cent. were males. A general review is given of the relationship of Tabanids to diseases, with lists of the species concerned in various parts of the world.

The Sheep Blowfly.—*J. Dept. Agric. Victoria*, xxvii, pt. 9, pp. 553–566, 6 figs. Melbourne, September 1929.

A popular account is given of the sheep blow-flies occurring in Australia, with notes on their life-history and control, and a description of traps for them [*R.A.E.*, B, xi, 21 ; xiv, 73, 91]. A successful dressing for infested sheep consists of 6 parts creosote, 20 parts turpentine and 40 parts olive oil or raw linseed oil ; this should be applied with a swab after dislodging the maggots and cleaning the affected area with a solution of one tablespoon of lysol in a quart of water.

Dunn (L. H.). **Notes on some Insects and other Arthropods affecting Man and Animals in Colombia.**—*Amer. J. Trop. Med.*, ix, no. 6, pp. 493–508. Baltimore, Md., November 1929.

During a campaign against yellow fever in Colombia in 1923 and 1924, a collection was made of the more common noxious Arthropods observed, of which an annotated list is given. They include *Anopheles albimanus*, Wied., which is the principal malaria carrier in Colombia ; *A. tarsimaculatus*, Goeldi, and *A. argyritarsis*, R.-D., which are also transmitters ; *A. pseudopunctipennis*, Theo., a possible carrier ; *A. punctimacula*, D. & K. ; *Aëdes argenteus*, Poir. (*aegypti*, auct.) which, though yellow fever no longer occurs in Colombia, is still important as a carrier of dengue ; many other Culicids ; 9 species of Tabanids ; the Muscids, *Stomoxys calcitrans*, L., and *Cochliomyia macellaria*, F. ; *Dermatobia hominis*, Say ; *Simulium sanguineum*, Knab ; various fleas, ticks and lice ; the Reduviid, *Triatoma geniculata*, Latr. ; and the Argasids, *Ornithodorus venezuelensis*, Brumpt, which is a parasite of man, and *O. talaje*, Guér., which is believed to be a common parasite of rats and is capable of transmitting relapsing fever.

Matheson (R.). **A Handbook of the Mosquitoes of North America.**—Med. 8vo, xvii+268 pp., 26 pls., 23 figs. London, Baillière, Tindall & Cox. Price, 25*s.* net.

This handbook presents a concise account of the mosquitos occurring in North America, with summaries of their life-histories, habits, breeding-places and relations to man, and a discussion of the problems of their control. A section is devoted to elementary taxonomy, and keys are given to the genera, and to the adults, males and larvae of the species of *Anopheles*, *Aëdes*, *Culex*, *Theobaldia* and *Psorophora*. Many of the text figures are original, and an index is appended.

Matheson (R.). **The Utilisation of Aquatic Plants as aids in Mosquito Control.**—*Amer. Nat.*, lxiv, no. 690, pp. 56–86, 12 figs., 3 pp. refs. New York, N.Y., January–February 1930.

The observations of various workers on aquatic plants inimical to mosquitos are reviewed, and an account is given of the author's studies on *Chara*, etc. [*R.A.E.*, B, xvi, 141 ; xvii, 214 . Of predacious plants, the most common is *Utricularia vulgaris*, two small branches of which were placed by the author in a battery jar, into which, during 5 days, 425 larvae of *Culex territans*, Wlk., were introduced. Almost all of

them were captured by the plant. There is a conflict of evidence as to the value of surface-covering plants, such as species of *Azolla* and *Lemna*.

HACKETT (L. W.). **Differences in the Habits of Anophelines which transmit Malaria in America, in Europe and in the Far East.** *Southern Med. J.*, xxii, no. 4, pp. 367–371, 4 refs. Birmingham, Ala., April 1929.

The author emphasises the importance of studying the bionomics of the Anophelines responsible for the transmission of malaria in any particular locality, before attempting to control the disease, and cites a number of instances to illustrate the danger of generalising from observations on a single species in a restricted area.

Certain malariologists are of the opinion that malaria will disappear wherever land is brought into a high state of cultivation and the economic status of the population is improved, and that consequently raising the standard of living, together with the use of quinine, is of more value in reducing the disease than is mosquito control. The author contends that the disappearance of endemic malaria from localities in which no measures have been consciously taken against Anophelines has only been observed in temperate climates, and is possibly confined to Europe. It never occurs in the tropics, although many areas of intense cultivation and considerable prosperity are to be found there. He believes that the absence of malaria from certain regions in Europe in which *Anopheles maculipennis*, Mg., is prevalent, is accounted for by the fact that the adult mosquitos attack domestic animals instead of man in these regions [*R.A.E.*, B, xv, 181, etc.].

Another theory that has recently been proposed, both in England and in Brazil, is that malaria is transmitted mainly by the relatively few individual Anophelines that remain indoors after their first blood-meal. In view of this, the capture of resting mosquitos in houses has been recommended as an important measure in the control of the disease. This is certainly not applicable to the Far East, however; *A. culicifacies*, Giles, and *A. listoni*, List., in Ceylon, *A. maculatus*, Theo., in Malaya, and *A. minimus*, Theo., in the Philippines, are rarely found in houses during the day, although they are the chief vectors of malaria in these countries.

In the United States, the drainage of swamps and ponds, by means of open canals and ditches, is usually effective in reducing malaria incidence, by diminishing the numbers of *Anopheles quadrimaculatus*, Say; even when the streams are dammed up to form lakes for providing water power, the waters become unattractive to this mosquito after four or five years. In Europe, however, *A. maculipennis* breeds along the edges of running streams as well as in ponds, so that similar drainage measures have little effect.

Not only are there important differences between the bionomics of different Anophelines, but the habits and relation to malaria of a single species may vary in different localities. An infection rate of 7 per cent. was found in *A. aconitus*, Dön., in western Java, whereas in Sumatra, in the same year, at the height of a malaria epidemic, 1,000 specimens were dissected with negative results. In the case of *A. ludlowi*, Theo., there are two fairly distinct strains, one breeding in fresh hill streams, and the other in mangrove swamps and other places where the water is brackish; the salt water strain is of great importance as a vector of

malaria in Malaya and Java, but entirely harmless at Manila, where it breeds in fish ponds. In Europe, *A. bifurcatus*, L., is a wild species, never found in houses, but in Palestine it enters houses freely, and is an important vector of malaria.

In the discussion that followed, I. J. Kligler stated that in Palestine individuals of *A. sacharovi*, Favr (*elutus*, Edw.) infected with malaria mostly remain in houses from June to September, but live out of doors from September to January, whereas infected individuals of *A. superpictus*, Grassi, may be found either in houses or in stables both in summer and winter. He also cited an instance of the draining of a marshy area in Palestine, in which 95 per cent. of the Anophelines were *A. sacharovi*; the result of the operation was that although the total Anopheline population was not reduced, *A. superpictus*, which prefers running to stagnant water, became the predominant species, and the problem of control was made easier.

CARLEY (P. S.) & BALFOUR (M. C.). **Prevalence of Malaria in Humphreys and Sunflower Counties, Mississippi, in 1927-28.**—*Southern Med. J.*, xxii, no. 4, pp. 377–381, 1 chart, 4 refs. Birmingham, Ala., April 1929.

In the course of this study of malaria in two entirely rural counties of the Mississippi Delta, where the disease is very prevalent, collections of adult Anophelines were made inside and under selected houses, and in barns, at intervals of not more than a fortnight, from August 1927 to October 1928. The only species of *Anopheles* found inside houses was *A. quadrimaculatus*, Say, which was taken in each month, the average number captured in each house in 10 minutes being 1 or less from December to March, 3·3–6·2 in April, October and November and 14·1–19·7 from May to September. In all the collections made in barns and under houses, only 24 individuals of *A. punctipennis*, Say, 3 of *A. pseudopunctipennis*, Theo., and 1 of *A. crucians*, Wied., were caught.

MELENEY (H. E.), BISHOP (E. L.) & ROBERTS (F. L.). **Observations on the Malaria Problem of West Tennessee.**—*Southern Med. J.*, xxii, no. 4, pp. 382–394, 5 maps, 3 refs. Birmingham, Ala., April 1929.

This is an account of a survey of part of western Tennessee that is subject to floods from the Mississippi River. The incidence of malaria is high, and the whole of the area liable to flooding is suitable for the breeding of *Anopheles quadrimaculatus*, Say. Except in a few localities, the larvae were not numerous, probably owing to the activities of top minnows [*Gambusia*], but the total breeding area was very extensive, and the adults occurred almost everywhere. In areas not subject to flooding, *A. quadrimaculatus* was found breeding in swamps, pools, etc., where there were more algae to protect it and fewer minnows. Larvae of *A. punctipennis*, Say, occurred in streams, pools, etc., but adults were rarely seen in or about habitations.

Drainage cannot be accomplished quickly, for various reasons. The area is too large for the general use of larvicides, and rendering houses mosquito-proof is the measure most likely to produce immediate results.

A list is given of 13 species of Culicines collected in western Tennessee, with indications of their breeding-places.

Clarkson (L. M.). **Oil Mixtures and Oil Equipment for Anopheline Larvae Control of impounded Areas.**—*Southern Med. J.*, xxii, no. 4, pp. 397–398. Birmingham, Ala., April 1929.

The author tested several types of oil on a large scale for the control of Anopheline larvae in impounded waters in Georgia. Mixtures of fuel oil and kerosene in various proportions failed to produce a satisfactory film on the water, and did not give very good results. A mixture of equal parts kerosene and transil oil spread well and gave excellent results, but transil oil, which is a very highly refined lubricating oil, is too expensive for general use. Almost complete control of Anopheline larvae was obtained with a mixture of 20 per cent. black oil, 20 per cent. kerosene and 60 per cent. paraffin oil, the black oil maintaining the film, the paraffin oil acting as a spreader and the kerosene being toxic. This mixture was used at the rate of $2\frac{1}{2}$ U.S. gals. to the acre (968 yards of shore line, the width of the film being 15 ft.), and the total cost, including labour but excluding equipment, was about 5*s.* 6*d.* an acre for each application.

Gill (D. G.), Kiker (C. C.) & Sims (L. C.). **Practical Application of Paris Green as a Larvicide for *Anopheles* Larvae on an impounded Lake in Alabama.**—*Southern Med. J.*, xxii, no. 4, pp. 399–404, 6 refs. Birmingham, Ala., April 1929.

Oiling had been employed almost exclusively for the control of Anophelines in large areas of impounded water in Alabama up to 1927, and good results had generally been obtained. In 1927, however, it failed to control *Anopheles quadrimaculatus*, Say, over considerable areas of one large lake, chiefly on account of the presence of vegetation; it was therefore decided to employ Paris green on these areas. Powdered soapstone was chosen as the diluent because it was readily obtainable, uniform in quality, most economical under the particular conditions and least absorbent, and because it appeared to float and carry in a dust cloud with the Paris green, so that its presence on the water indicated where the poison had been applied.

In preliminary tests in June 1928 it was found that when the dust was applied at the rate of 1 lb. to the acre, not enough Paris green reached all areas, with a 1 per cent. dust; the amount of Paris green was therefore increased to 5 per cent. In spite of this, the results obtained were not uniform, the mortality of the larvae being not more than 50 per cent. in some places, although in others, and in pans, it was nearly 100 per cent. The Paris green used was found to contain 52·36 per cent. arsenic trioxide, and thus conformed to specification.

Experiments were therefore carried out to determine the cause of the ineffectiveness of the applications in certain cases. In the four brands of Paris green tested, all the particles were small enough to pass through a 200-mesh sieve. This fineness appeared to be satisfactory, but an approximate 300-mesh standard might be preferable. Paris green graded to pass through a 130-mesh sieve, but not through a 200-mesh one, was useless as a larvicide. A comparison of soapstone with hydrated lime and kaolin as diluents did not indicate that any one of these was distinctly superior to the others from the point of view of its effect on larval mortality.

The chief factor responsible for the inefficiency of the Paris green in certain cases appeared to be that most of it sank too quickly. In one experiment, in which only 36 per cent. mortality was obtained

among larvae in a breeding-place, most of the Paris green sank immediately, whereas in an accompanying pan test, in which 96 per cent. mortality was obtained, the amount on the surface of the water was almost unchanged after two hours. This was found to be the case in all the experiments in which almost complete control was obtained, both in pans and in breeding-places. In the most successful experiments the particles of Paris green remained afloat and uniformly distributed ; in others they collected into groups. The determining factor appears to be the surface-tension of the water ; observations indicate that the surface-tension increases with an increase in the amount of vegetation and floatage in the water. Whether the diluent sank readily or remained on the surface was apparently immaterial.

Teixeira Filho (A. M.). **A malaria. Transmissão, perigos, prophylaxia.** [Malaria, its Transmission, Dangers and Prophylaxis.] —*Folha Med.*, x, no. 36, pp. 444–449. Rio de Janeiro, 25th December 1929.

This account of malaria includes notes on Brazilian Anophelines and on recognised methods of combating them [*R.A.E.*, B, xvii, 85, etc.].

Barreto (J. de B.). **Do espurgo por nebulisação de insecticidas na lucta contra a malaria.** [Destruction of Insects by Spraying with Insecticides in Work against Malaria.]—*Sciencia med.*, vii, no. 11, pp. 527–532. Rio de Janeiro, November 1929.

The successful destruction indoors of adults of *Aëdes argenteus*, Poir. (*aegypti*, auct.) in Brazil by a spray of kerosene containing 3·5 per cent. carbon tetrachloride [*R.A.E.*, B, xvii, 253] led to experiments against Anophelines. The addition of 5 per cent. pyrethrum (by maceration for one week in the kerosene) having rendered the spray very effective against house-flies [*Musca*] as well as *A. argenteus*, this combination was employed with entirely satisfactory results against the Anophelines. In no case was less than 25 cc. per cubic metre used, and in 95 per cent. of the cases the amount was 30 cc. or more.

de Almeida Cunha (R.). **Notas de siphonapterologia. Questoes de systematica.**—*Sciencia med.*, vii, no. 11, pp. 549–550. Rio de Janeiro, November 1929.

Tritopsylla, n. n., is proposed for *Stenopsylla*, Alm. Cunha [*R.A.E.*, B, iii, 82], which is preoccupied in Psyllidae.

Shannon (R. C.) & Seraphim Junior (J.). **Notas sobre a frequencia dos Anophelineos da capital da Bahia e seus arredores, especialmente alguns do grupo *Nyssorhynchus*, considerados de importancia como os mais provaveis vehiculadores da malaria nessa região.** [Notes on the Abundance of Anophelines of the Capital of Bahia and its Environs, especially some of the *Nyssorhynchus* Group considered important as the most probable Carriers of Malaria in this Region.] —*Sciencia med.*, vii, no. 11, p. 584. Rio de Janeiro, November 1929.

Of the Anophelines found in and around Bahia, *Anopheles* (*Nyssorhynchus*) *argyritarsis*, R.-D., *A.* (*N.*) *albitarsis*, Arrib., and *A.* (*N.*) *tarsimaculatus*, Goeldi, are the commonest. The latter is very abundant in winter.

Cleland (J. B.). **Dengue Fever in Australia.**—*Rev. prat. Mal. Pays chauds*, viii, no. 10, pp. 509–514, 6 refs. Alexandria, October 1928.

This is a review of investigations on the aetiology and transmission of dengue, particularly those carried out in Australia (*R.A.E.*, B, iv, 196 ; ix, 127). Australia is particularly suitable for research on dengue, as no other disease with which it might be confused occurs there. The experimental evidence that it is transmitted by *Aëdes argenteus*, Poir. (*calopus*, Mg.), but not by *Culex fatigans*, Wied., is supported by the distribution of these two mosquitos. Dengue has never been naturally contracted south of about 100 miles north of Sydney, and the southern limit of the range of *A. argenteus* corresponds almost exactly with that of the disease, whereas *C. fatigans* probably occurs throughout Australia.

Watson (Sir M.). **Twenty-five Years of Malaria Control in the Malay Peninsula—1901–1926.**— *J. Trop. Med. & Hyg.*, xxxii, no. 23, pp. 337–340. London, 2nd December 1929.

This review of the progress of anti-malarial measures from 1901 to 1926 in the Malay Peninsula, where mosquito extermination by means of drainage of swamps was successfully used in the control of malaria for the first time, includes a brief account of the development of species sanitation, jungle preservation, subsoil drainage and oiling for the control of Anophelines breeding in mountain regions and quick-running streams, and of the manner in which Malayan methods have been adopted in malaria control in other parts of the world. The future of biological control by means of the regulation of the pH content of waters in which mosquitos are found breeding is briefly discussed.

Covell (G.). **Malaria in Bombay, 1928.**—Med. 8vo, v—113 pp., 4 maps. Bombay, Govt. Central Press, 1928. Price, 2*s.* 6*d.*

An enquiry into malaria conditions on the Island of Bombay in 1928 has shown that the disease at present constitutes a serious cause of ill health and loss, its incidence having increased rather than diminished during the past 30 years and the most severely affected parts of the Island being the areas in which most of the mills are situated. There is no natural malaria, the breeding-places of the vector, *Anopheles stephensi*, List., being exclusively due to human agency. The solution of the problem lies in the carrying out of a systematic campaign for the elimination of all potential breeding-places of this species, particularly the permanent ones that allow of breeding throughout the year. The measures that should be adopted are suggested in this report. The most important are the permanent closing of every well in the Island, the rendering of every cistern mosquito-proof, the abolition of all garden tanks and tubs, and the weekly treatment of mill-ponds with Paris green. The success of such a scheme depends on a plan of organisation, such as is outlined by the author, who feels confident that endemic malaria in the Island can be brought under complete control and might indeed be eradicated. The scheme suggested does not involve any greater sum than the amount lost each year by the City on account of the disease. Malaria in Bombay seems to occur in waves, a few years of intensity alternating with periods of diminished prevalence. At the present time it is apparently declining, and a favourable

opportunity for a prevention campaign is offered. The author points out that *A. stephensi* occurs throughout India and will breed in unprotected cisterns in any town provided with a piped water-supply, so that the introduction of this system into any place is likely to bring an increased incidence of malaria.

KING (Harold Holmes). **Supplement to the Annual Report of the King Institute of Preventive Medicine, Guindy, for 1927-28.**— Fol., 58 pp., 2 pls., 3 sketch maps, 2 charts. Madras, Govt. Printer, 1929. Price, *Re.* 1 *As.* 4.

The first 41 pages of this supplement contain reports on malaria surveys of various small areas in the Madras Presidency undertaken in 1926 and 1927. In the Mopad district prior to 1921 dry crops (millets) were cultivated by means of well irrigation, the subsoil water was about 25 ft. below the surface and malaria does not appear to have been prevalent. As a precaution against famine, a reservoir was constructed by damming a river ; this resulted in the cultivation of wet crops (rice) by means of canal irrigation, the level of the subsoil water was raised and malaria became severe. The high level of the subsoil water produces mosquito breeding-places in pits and probably in pools and streams in the river bed below the dam and maintains them in such places as irrigation channels by preventing the absorption of water into the soil. The most numerous Anopheline was *Anopheles subpictus*, Grassi (*rossi*, Giles), which does not transmit malaria. The vectors found were *A. culicifacies*, Giles, *A. stephensi*, List., and *A. listoni*, List., of which the first-named was not only the most numerous but also the most heavily infected, the percentage being 7·74 as compared with 5·42 and 3·9 for the other two species respectively. Larvae of *A. fuliginosus*, Giles, were found in pools at the edge of the reservoir, but no adults were collected. In order to control malaria, mosquito breeding-places should be reduced, either by reverting to the cultivation of dry crops, thus lowering the subsoil water level so that water does not remain for long periods in the beds of streams and drains, or, if wet crop cultivation is to be continued, by careful draining and filling of areas that cannot be drained. In either case the canalisation of the river below the dam would be necessary.

Surveys were also made at Udayagiri and Duttalur. The same species of Anophelines were present, with the addition of *A. jamesi*, Theo., and *A. culicifacies* again proved to be the most important carrier of malaria. In Udayagiri the incidence of malaria has increased during recent years and appears to correspond to the abnormally high rainfall that has lately been experienced. In Duttalur malaria is not very prevalent, and as the climate and type of country are similar to those in Mopad, the survey tends to confirm the conclusion that wet crop irrigation is mainly responsible for the higher incidence of malaria in the latter area. A comparison of surveys of Duttalur and Udayagiri illustrates the differences in malaria prevalence that may be brought about mainly by local climatic variations when other conditions are similar. In 1926 the north-east monsoon rains failed and larvae and adults were scarce at Udayagiri and Duttalur, where breeding-places are dependent on rainfall, but plentiful at Mopad. At the time of the first Mopad survey in March adult Anophelines were rare owing to the onset of the hot dry season, while at Udayagiri and Duttalur they were abundant owing to the unusual local rainfall. In

November, at the time of the second survey at Mopad, they were numerous despite the failure of the monsoon rains and the consequent inappreciable increase in breeding-places, a fact confirming the suggestion that monsoon seasons favour malaria in localities where breeding-places are numerous, chiefly because they are associated with atmospheric conditions of temperature and humidity that promote longer life in Anophelines and assist the development of the parasite in the mosquito.

In view of the proposed construction of a new harbour at Vizagapatam, a malaria survey was made of the area acquired for labourers' quarters. Although several other species of Anophelines were observed, *A. culicifacies* was the only one living in close association with man, and there is no doubt that it is the chief malaria carrier in this region.

A survey of the town of Vizagapatam in April indicated that the chief carriers of malaria are *Anopheles stephensi* in the densely populated part of the town and *A. culicifacies* in the outlying areas. In a further survey carried out in September, after the south-west monsoon, it was found that *A. culicifacies* had displaced *A. stephensi*, the natural well-breeding species, in most of the wells.

PURI (I. M.). **Description of the Male, Female, Egg and Larva of *Anopheles annandalei* var. *interruptus* nov. var., with Corrections for the previous Descriptions of the Type Species.**—*Ind. J. Med. Res.*, xvii, no. 2, pp. 385–395, 1 pl., 10 refs. Calcutta, October 1929.

The male, female, egg and larva of *Anopheles annandalei* var. *interruptus*, n., are described from the eastern Himalayas. Points of difference between the adults and larvae of this variety, the typical *A. annandalei*, Prashad, and *A. asiaticus*, Leic., are tabulated. *A. annandalei* var. *djajasanensis*, Brug, is not considered a distinct variety.

PURI (I. M.). **A new Tree-hole breeding *Anopheles* from South India—*Anopheles sintoni* sp. nov.—and a revised Description of the Larva of *A. culiciformis* Cogill.**—*Ind. J. Med. Res.*, xvii, no. 2, pp. 397–404, 1 pl., 7 refs. Calcutta, October 1929.

The characters distinguishing the adult and full-grown larva of *Anopheles sintoni*, sp. n., from Malabar, from those of *A. culiciformis*, Cogill, with which it has previously been confused, are given. A revised description of the full-grown larva of *A. culiciformis* is also given, as the previous description [*R.A.E.*, B, iv, 124] was based on specimens belonging to the two species.

KING (Harold Holmes), PANDIT (C. G.), MENON (K. P.) & SEETHARAMA IYER (P. V.). **A House to House Filariasis Survey in Saidapet, 1927-1928, and a Note on the Source of Filarial Infection in Mosquitoes.**—*Ind. J. Med. Res.*, xvii, no. 2, pp. 406–420, 1 pl., 1 fig., 1 plan, 6 refs. Calcutta, October 1929.

In addition to a house-to-house filariasis survey of certain typical areas in the town of Saidapet, a mosquito survey was also undertaken from 20th October to 10th February. Of the 1,882 female mosquitos dissected, 52 were *Anopheles subpictus*, Grassi, and showed no infection, 29 were *Aëdes albopictus*, Skuse (*scutellaris*, Theo.), of which two

contained filaria without further developmental forms, and 1,741 were *Culex fatigans*, Wied., of which no less than 603 or 34·6 per cent. were found to be infected with microfilariae or later stages. Most of the houses in the town are drained into small cement pits that are supposed to be emptied by hand every morning, and these pits, which receive washing water and sometimes sewage, are the chief source of *C. fatigans*. Wells are numerous, but the mosquitos appear to use them for shelter during the day rather than for breeding purposes. The distribution of mosquitos and of infected ones was remarkably uniform from house to house. It was found that a high or low microfilaria rate in man was associated respectively with a high or low infective mosquito rate, and similarly that the infected mosquito rate and the microfilaria rate were related, though less closely. The local microfilaria rates do not, however, correspond closely to the local filarial disease rates; the latter appear to be correlated to a certain extent with differences in the relative mosquito density, with differences in the occupation of the inhabitants and probably with conditions that favoured filariasis in the past.

Examination of the blood in the stomachs of 33 mosquitos showed it to be human or bovine or a mixture of the two; avian and reptilian blood appeared to be absent. The only microfilaria found in infected mosquitos was *Filaria bancrofti*. Out of 203 dogs examined, only 3 were found to have microfilariae (either *F. immitis* or *F. recondita*) in their blood. Attempts to infect mosquitos from these dogs were unsuccessful (although development is known to take place in *C. fatigans*), probably because the degree of infection was too low. Although microfilariae were observed in the stomachs of mosquitos fed on crows and calves infected with their respective species of filaria, no development occurred, and the lizard filaria [see next paper] was not found in mosquitos at Saidapet. Birds, reptiles, dogs and cattle cannot, therefore, be considered to be the source of filarial infection of *C. fatigans* caught in houses, except possibly to an exceedingly small degree.

PANDIT (C. G.), PANDIT (S. R.) & SEETHARAMA IYER (P. V.). **The Development of the Filaria** *Conispiculum guindiensis* **(1929) in** *C. fatigans*, **with a Note on the Transmission of the Infection.** - *Ind. J. Med. Res.*, xvii, no. 2, pp. 421–429, 2 pls., 1 fig., 1 graph, 1 ref. Calcutta, October 1929.

The development of *Conispiculum guindiensis* in *Culex fatigans*, Wied., is described. The mosquitos were infected by feeding them on lizards (*Calotes versicolor*) showing a fair number of microfilariae in the peripheral blood; it was invariably noticed that heavily infested lizards were unsuitable, as a high death rate in the mosquitos occurred within the first 24 to 48 hours. Even under favourable conditions the mortality among the fed mosquitos was 35 per cent. within the first 24 hours, when the young larvae pierce the wall of the stomach, and it remained high during the first six days, after which it decreased. The longest period an infected mosquito lived under laboratory conditions with only one blood meal (the infecting one) was 62 days. The complete development in the mosquito from the day of the infecting feed until the appearance of the fully developed forms in the proboscis generally occupies 12–15 days. The microfilariae pass through stages of development similar to those of *Filaria bancrofti*. The fully

developed larvae are usually found in the head and proboscis, but were also seen in the abdomen and even in the legs. This is probably due to the intensity of the infection. The active migration of a large number of these larvae seems to cause little injury to the mosquito, for the death rate at this stage is low. The morphological differences between the larvae of *C. guindiensis* and *F. bancrofti* are given. Experiments showed that infection can be transmitted to healthy lizards by the bite of infected mosquitos.

CHRISTOPHERS (S. R.). **Note on a Collection of Anopheline and Culicine Mosquitoes from Madeira and the Canary Islands.**—*Ind. J. Med. Res.*, xvii. no. 2. pp. 518–530. 2 pls., 1 map. 24 refs. Calcutta, October 1929.

The following is taken from the author's summary : The Culicid fauna of the Canary Islands includes the species *Anopheles hispaniola*, Theo., *A. sergenti*, Theo., *Theobaldia longiareolata*, Macq., *T. annulata*, Schr., *Aëdes argenteus*, Poir., *A. detritus*, Hal., *A. caspius*, Pall., *Culex hortensis*, Fic., *C. theileri*, Theo., *C. laticinctus*, Edw., *C. apicalis*, Adams, and *C. pipiens*, L. ; that of Madeira, the species *T. longiareolata*, *Aëdes eatoni*, Edw., *C. hortensis*, *C. theileri*, and *C. pipiens*.

This fauna is typical of the Mediterranean Sub-region. The Culicid fauna of Madeira might be compatible, except for the presence of *A. eatoni*, Edw., with recent introduction, even by man. The origin of the Canary Islands fauna is less suggestive of an altogether recent introduction, and introduction through a land connection some time in the Miocene is discussed, though there is no certain evidence that a land connection ever existed, and the most that can be said is that it is probable that the Anopheline fauna is not merely a recent introduction by man.

WIRSSALADSE (S. S.). **Zur Epidemiologie der Malaria im Alasanbezirk (Signacher Kreis, Ost-Georgien) nach den Ergebnissen der wissenschaftlichen Expedition vom Jahre 1927.** On the Epidemiology of Malaria in the Alasan District (Signacher Division, East Georgia) according to the Results of the scientific Expedition of 1927. —*Arch. Schiffs- u. Tropenhyg.*, xxxiv, no. 1, pp. 18–28 Leipzig, January 1930.

Both natural and social conditions in the valley of the Alasan river favour malaria, and the disease is endemic there. The swamps on both banks are the breeding-places of *Anopheles maculipennis*, Mg., *A. superpictus*, Grassi, and various Culicines.

[ANANYAN (S. A.). **Ананян (С. А.). Sur la biologie d'*Anopheles pseudopictus* Grassi en l'ouezd d'Etchmiadsine en Arménie et sur la lutte conduite contre les moustiques hibernants.** *In Russian.*] —*Russ. J. Trop. Med.*, vii. no. 6. pp. 425–428. 1 fig. Moscow, 1929. (With a Summary in French.)

Of the mosquitos abundant in the Echmiadzin district (south Armenia), the Anophelines are *Anopheles maculipennis*, Mg., *A. super-*

pictus, Grassi, *A. hyrcanus* var. *pseudopictus*, Grassi, *A. plumbeus*, Steph., and *A. bifurcatus*, L. One of the methods of controlling them is the fumigation of their hibernation quarters, for which purpose a mixture of cow dung and sulphur is burned in cow-sheds and tobacco dust in human dwellings. The mosquitos are driven by the fumes into a box-trap fixed to an opening in the roof and then killed by exposure to the fumes of burning sulphur. Examinations of the mosquitos thus destroyed during four consecutive years showed that 98–99 per cent. of them were *A. maculipennis* and 0·5–2 per cent. *A. superpictus*. Culicines were very rare, and *A. hyrcanus* var. *pseudopictus* only occurred once, although in the summer it represented 25–40 per cent. of all the mosquitos captured in some villages. This species was absent in the colder hibernation places, such as cellars, and the author suggests that in Armenia it hibernates either in the larval stage under the ice, or as an adult amidst dry grass and plants under snow.

[Sergiev (P. G.).] **Сергиев (П. Г.). Compte-rendu des études poursuivies aux cours organisés par la Section hygiénique de La Société des Nations.** [*In Russian.*]—*Russ. J. Trop. Med.*, vii, nos. 6 & 7, pp. 384–389 & 439–448. Moscow, 1929.

In the first part of this report the author gives an account of anti-malaria work at the Chief Anti-malaria Institute, 124 miles west of Madrid. The topography of the country, which is an endemic focus of malaria, is described, the prevailing Anopheline being *Anopheles maculipennis*, Mg. The fish, *Gambusia affinis*, which breeds freely in Spain, is introduced into nearly every artificial and natural reservoir likely to harbour Anopheline larvae. Those in which the fish is not kept are dusted at intervals of 10 days from the beginning of April with a mixture of Paris green and road dust, 1 : 100.

The second part deals with the organisation of the anti-malaria campaigns in Italy ; the work carried out by the anti-malaria stations is briefly reviewed, and the methods of reclaiming marshes and improving the land are described. Dusting with Paris green is continued from April to October. The dust is applied between 6 and 10 a.m., at intervals of 30 days in April, 15 days in May, 8 days in June, July and August, and 10 days in September. Dusting from aeroplanes in some marshy places is carried out every 12–13 days, 1 lb. Paris green being used to 2¼ acres of water surface. The mosquitos are not destroyed during hibernation, on the theory that it is impossible to kill all of them, and that only a certain number of the larvae can develop in a given number of water reservoirs, irrespective of the amount of eggs deposited, as under crowded conditions numerous larvae die from lack of food.

The absence of malaria in a locality near Naples, where Anophelines are numerous, is discussed ; the author does not agree with the theory of Missiroli and Hackett that the mosquitos have developed a preference for feeding on animals [*R.A.E.*, B, xv, 181], and suggests that here, as in other places, the absence of the disease is due to the improved rural conditions and economic status of the population.

[Bogoyavlenskiĭ (N. A.).] **Богоявленский (Н. А.). Quelques observations sur le *Phlebotomus* constaté à Kazach.** [*In Russian.*]—*Russ. J. Trop. Med.*, vii, no. 7, pp. 461–469. Moscow, 1929.

This is an account of observations made in 1928 on the bionomics of *Phlebotomus* in a district of Azerbaijan where frequent epidemics of

sandfly fever occur. The sandflies were observed from the second half of June until the end of November, but no eggs or larvae could be found in nature or obtained in the laboratory. Captive females refused to feed. Experiments in the reaction of the sandflies to various colours showed that they were most attracted by white and least by yellow. This colour should therefore be used for distempering or papering walls in houses, and for window curtains. Although the sandflies were much attracted by artificial light, they preferred to feed in dark rooms. The number of sandflies in a house was not diminished by the presence of a horse and dogs in the yard, but increased in direct proportion to the number of persons ; they were especially abundant in military barracks.

[Kolmuikov (E. S.) & Zadul'skaya (E. S.).] **Колмыков (Е. С.) и Задульская (Е. С.). Ecologie des gîtes d'hibernation des *Anopheles* dans les conditions des exploitations tourbières.** [*In Russian.*]—*Russ. J. Trop. Med.*, vii, no. 7, pp. 469–475, 15 refs. Moscow, 1929.

A brief account is given of observations on the hibernation places of *Anopheles maculipennis*, Mg., and *Culex pipiens*, L., carried out in March and April 1929 in workmen's settlements near turf-pits in the Moscow Government. No mosquitos were ever found hibernating in the open air or in warm quarters. A very few Anophelines occurred in disused houses and draughty cattle sheds, and somewhat larger numbers in barns, etc., which also occasionally harboured *C. pipiens*. Dark places were preferred, *A. maculipennis* alone being sometimes found in lighted ones. *Culex* occurred in damper places than *Anopheles*, but excessive dryness or humidity of the air were fatal to both species. *A. maculipennis* was most numerous in places where the temperature was subject to slight changes, while an even temperature, but not lower than −15° C. [5° F.], was essential for *C. pipiens*. Cellars offered optimum conditions for hibernation, namely, a low and even temperature of from 0 to −10° C. [32–14° F.], absence of light and ventilation, and a comparatively low degree of humidity, and the majority of mosquitos hibernated in them, *A. maculipennis* chiefly in cellars under the floor of inhabited houses, and *C. pipiens* in those at some distance from dwellings.

[Ben'yaminson (E. S.) & Nabokov (V. A.).] **Беньяминсон (Е. С.) и Набоков (В. А.). Les différents produits du pyrèthre dans la lutte avec les Anophèles hibernants.** [*In Russian.*]—*Russ. J. Trop. Med.*, vii, no. 7, pp. 476–486. Moscow, 1929. (With a Summary in French.)

Successful experiments with pyrethrum against hibernating adults of *Culex pipiens*, L., at temperatures just below freezing point are described. In one instance all the mosquitos fell to the ground in 10 minutes after the powder had been released on or near them. In another experiment 75 per cent. of those hibernating in a cellar fell to the ground within an hour after dusting at the rate of 2 oz. pyrethrum to 1,000 cu. ft., and although the rest remained on the walls, they fell as soon as a lantern, which gave out some warmth, was brought near them. All the paralysed mosquitos subsequently died.

[Nabokov (V. A.) & Grinberg (N. A.).] **Набоков (В. А.) и Гринберг (Н. А.). Toxicité comparée des différents gaz par rapport aux moustiques et leur application pratique dans la lutte avec l'hibérnation.** [*In Russian.*]—*Russ. J. Trop. Med.*, vii, no. 8, pp. 521–529, 5 refs. Moscow, 1929.

An account is given of experiments with eight gases for fumigation against hibernating mosquitos, but they are considered of little practical value, as they are either too dangerous to use in or near inhabited houses or too expensive.

[Nabokov (V. A.).] **Набоков (В. А.). Nouvel appareil combiné pour la désinfection et désinsectisation.** [*In Russian.*]—*Russ. J. Trop. Med.*, vii, no. 8, pp. 530–536, 1 diagr., 3 refs. Moscow, 1929. (With a Summary in French.)

A detailed description is given of an apparatus constructed by the author, which may be used for fumigation with sulphur dioxide, tobacco dust, or formaldehyde. It consists of a metal cylinder with a conical lid, which has a wide opening in the centre from which a pipe carries the gas into the place to be fumigated, thus avoiding the risk of fire. Sulphur or tobacco dust is burnt in three shallow dishes fixed inside the cylinder one above the other, the two upper ones having a wide opening in the centre to allow the fumes from the bottom dish to ascend. Ventilation openings are made in the cylinder on the level of the dishes. When disinfecting with formaldehyde, the latter is placed into a deep container and a spirit lamp is fixed at the bottom of the cylinder.

[Nikolaev (B. P.) & Yakovleva (V. V.).] **Николаев (Б. П.) и Яковлева (В. В.). Le sort des formes sexuées du *Plasmodium vivax* dans la cavité abdominale des *Culex*, *Theobaldia* et *Aëdes*.** [*In Russian.*]—*Russ. J. Trop. Med.*, vii, no. 9, pp. 577–582, 1 fig. Moscow, 1929. (With a Summary in French.)

Existing literature on the development of malaria parasites in mosquitos is briefly reviewed, and an account is given of observations, carried out in Leningrad in 1928, on *Plasmodium vivax* in *Anopheles maculipennis*, Mg., *Culex pipiens*, L., *Theobaldia alaskaensis*, Ludl., and *Aëdes salinellus*, Edw. Infection was not always produced in *A. maculipennis* after feeding on persons containing numerous gametocytes in the blood; in some cases the sexual forms were digested without the production of oökinetes. In the Culicines the sexual forms were not digested, and oökinetes were produced, but no oöcysts were found in them and no sporozoites occurred in their salivary glands. The authors therefore conclude that the resistance of these mosquitos to infection with human malaria does not depend on the effect of their digestive juices on the gametocytes, gametes and oökinetes, but probably on the penetration of the last-named into the walls of the stomach of the host and the subsequent development of oöcysts.

[Yakimov (V. L.).] **Якимов (В. Л.). Sur les *Spirochaeta theileri* en SSSR** [U.S.S.R.]. [*In Russian.*—*Russ. J. Trop. Med.*, vii, no. 9, p. 620, 1 fig., 2 refs. Moscow, 1929.

Referring to a previous record of *Spirochaeta theileri* in a cow on which larvae of *Boophilus annulatus calcaratus*, Bir., from the North Caucasus

had been fed [*R.A.E.*, B, xvii, 157], the author states that this spirochaete has been found on two occasions in cattle: once in 1927 in southern Ukraine, and once in 1929 in the northern Caucasus.

[Zaikin (N. G.).] **Заикин (Н. Г.).** *Anopheles bifurcatus* **dans l'Arrondissement de Penza.** [*In Russian.*]—*Russ. J. Trop. Med.*, vii, no. 9, p. 631. Moscow, 1929.

A few larvae of *Anopheles bifurcatus*, L., were found on 10th May 1929 in a forest about 6 miles from the town of Penza, breeding in a natural reservoir 65–80 ft. deep and 130 ft. in diameter, containing very clear and pure water with a temperature of 9° C. [48·2° F.]. The larvae were numerous in neighbouring small pools, the temperature of the water in them being 15° C. [59° F.]. Individuals placed in an aquarium pupated in two days. No larvae were found by the middle of July.

Roubaud (E.). **Suspension évolutive et hibernation larvaire obligatoire, provoquées par la chaleur, chez le moustique commun,** *Culex pipiens* **L. Les diapauses vraies et les pseudo-diapauses chez les insectes.**—*C.R. Acad. Sci. Fr.*, cxc, no. 5, pp. 324–326, 1 ref. Paris, 1930.

Under natural conditions, the larval development of *Culex pipiens*, L., is continuous. Hibernation of the larvae apparently does not occur, but by varying the temperature, the author succeeded in inducing, in both the town and country forms, artificial winter diapauses, such as occur naturally in such species as *Aëdes geniculatus*, Ol., or *Anopheles bifurcatus*, L. Arrested development occurs in the larvae of *C. pipiens* only when their development from the egg onwards is carried out at a continued high temperature of 25–28° C. [77–82·4° F.]. If this temperature is reduced by night to 16–20° C. [60·8–68° F.], development is rapid and uninterrupted. When, however, the high temperature is maintained day and night, development is soon retarded; only a few larvae pupate, after about 15 days, the majority remaining in the fourth instar. These larvae become more and more torpid, and eventually die after about 2 months. If, however, the moribund larvae are exposed for a few weeks to a temperature below 16° C. [60·8° F.], they once more become active and quickly pupate, if then subjected to a high temperature. This behaviour doubtless explains the rarity of *C. pipiens* in the tropics.

Hecht (O.). **Ueber die Eiablage von** *Anopheles bifurcatus*. [On the Oviposition of *A. bifurcatus*.]—*Arch. Schiffs- u. Tropenhyg.*, xxxiii, no. 12, pp. 640–644, 12 refs. Leipzig, December 1929.

Females of *Anopheles bifurcatus*, L., in a terrarium in which dishes of water were placed for oviposition laid only a few eggs in the water, the remainder being on the filter paper covering the bottom. Most of them were dried up and only a few hatched. It is well known that eggs of *A. bifurcatus* can hatch in damp earth. Larvae occur not only in partly shaded ditches and springs, but also among rushes round pools, and probably the wet ground there is used for oviposition. In a locality in Germany in which *A. bifurcatus* was abundant in May 1929, it was very scarce in September. It is suggested that this was due, not to the

larvae having perished through the abnormally dry weather, but to the eggs (laid in dry ditches, etc.) awaiting the autumn rains in order to produce the young hibernating larvae. If this view is correct, *A. bifurcatus* may be abundant in spring despite a scarcity of females in autumn.

MARTINI (E.). **Von meinem Besuch bei den Versuchsstationen für Malariabekämpfung in Italien.** [My Visit to the anti-malarial Experiment Stations in Italy.]—*Beih. Arch. Schiffs-u. Tropenhyg.*, xxxiii, no. 3, pp. 134–141. Leipzig, 1929.

The anti-malarial stations in Italy are chiefly occupied with testing the value of dusting with Paris green against Anopheline larvae. The author considers this method to be of considerable value.

BRAGINA (—). **Anopheleslarven fressende Hydra.** [A Hydra feeding on *Anopheles* Larvae.]—*Beih. Arch. Schiffs- u. Tropenhyg.*, xxxiii, no. 3, pp. 141–142, 1 fig. Leipzig, 1929.

A species of *Hydra* is recorded as feeding on larvae of *Anopheles maculipennis*, Mg., in an aquarium.

DINGER (J. E.). **Experimentelle Untersuchungen über Gelbfieber.** [Experimental Investigations on Yellow Fever.]—*Beih. Arch. Schiffs- u. Tropenhyg.*, xxxiii, no 3, pp. 167–171. Leipzig, 1929.

This is a report of experiments at Amsterdam by the author and others on the transmission of a strain of yellow fever virus originally of African origin by strains of *Aëdes argenteus*, Poir. (*Stegomyia fasciata*, F.) from Cuba and Java, and *A.* (*S.*) *albopictus*, Skuse, from Java. Both strains of *A. argenteus* readily transmitted the disease to *Macacus rhesus*, a single mosquito sufficing to cause a fatal infection. The monkeys recovered from infections by *A. albopictus*, but injections of the blood of one of them proved fatal. Two of the survivors subsequently proved immune from infection by *A. argenteus*. Some monkeys injected with an emulsion of infected *A. albopictus* died. This mosquito is therefore capable of transmitting yellow fever, but only to a limited extent, at any rate to monkeys. Examples of *M. cynomolgus* from Java were also susceptible to infection, but to a less degree than *M. rhesus*. The experiments therefore show that a potential vector exists in the Dutch East Indies, and also a more or less susceptible monkey population, so that these countries would be exposed to yellow fever if an infective case were imported. Experiments to test Stokes' result that mosquitos from eggs of infected parents failed to infect monkeys, though not definitely conclusive, appear to show that inheritance of yellow fever infection by Javanese examples of *A. argenteus* is very improbable.

ADLER (S.). **An Analysis of the Leishmania Sandfly Problem.**—*Trans. R. Soc. Trop. Med. & Hyg.*, xxiii, no. 3, pp. 289–300, 29 refs. London, 25th November 1929.

The method of transmission of cutaneous leishmaniasis is discussed from the literature on the basis of the following assumptions: that oriental sore is transmitted by *Phlebotomus*, for which there is abundant

experimental evidence; that there exist species of *Leishmania* common to man and dogs; and that canine leishmaniasis is transmitted by the bites of the sandflies, since dogs cannot crush the latter in their ears, where they are almost invariably attacked. The forms of *Leishmania* of man and dogs may be regarded, not as clearly defined fixed species, but as strains in the course of evolution under varying circumstances, there being no single character by which any one can be constantly differentiated from another. The frequent infections in the cardia, oesophagus and pharynx, and the rare infections in the proboscis with the Palestine strains of *L. tropica* in *Phlebotomus papatasii*, Scop., may be interpreted as a stage in the process of evolution towards the perfect method of transmission, *i.e.*, by bite, which is only rarely attained. From the knowledge and experimental data available, it is concluded that cutaneous leishmaniasis in Palestine may be transmitted by the bite, or by crushing, of infected *P. papatasii*. In Baghdad, on the other hand, the disease is readily transmitted by the bite of *P. sergenti*, Parr., though transmission by crushing is not excluded.

On somewhat similar grounds the author suggests that visceral leishmaniasis in the Mediterranean basin is transmitted by the bites of sandflies, whereas in India it is transmitted by the crushing of infected *P. argentipes*, Ann. & Brun., and only occasionally by bites. These assumptions would explain the differences in age incidence between Mediterranean and Indian kala-azar and the apparent absence of the disease in dogs in India.

YOANNOVITCH (G.). **Contribution à la biologie de l'*Anopheles superpictus* dans la Serbie du sud.**—*Bull. Off. int. Hyg. publ.*, xx, fasc. 7, p. 1060. Paris, 1928.

Anopheles superpictus, Grassi, which breeds exclusively in streams, appears much later in the season in southern Serbia than other species of *Anopheles*. The frequent rains and swollen torrents occurring in the spring destroy the first generations of this species. In the region of Skoplje the rains usually cease about the beginning of June, and *A. superpictus* appears in large numbers in the second half of July [*cf. R.A.E.*, B, xviii, 3].

GRAHAM (J. D.). **Résumé des travaux de la Commission du Kala-azar dans l'Inde britannique pendant l'exercice 1927-1928.**—*Bull. Off. int. Hyg. publ.*, xx, fasc. 10, pp. 1618–1623. Paris, 1928.

A brief outline is given of the work carried out by the Kala-azar Commission in India during the year 1927–28. Negative results were obtained when individuals of *Phlebotomus argentipes*, Ann. & Brun., fed on persons infected with kala-azar were made to bite experimental animals and human volunteers [*cf. R.A.E.*, B, xvii, 29], although dissection of a certain number of sandflies in each lot indicated that the rate of infection was never less than 20 per cent.

NAPIER (E.). **Travaux de la Commission du Kala-azar dans l'Inde britannnique en 1928.**—*Bull. Off. int. Hyg. publ.*, xxi, fasc. 5, pp. 778–781. Paris, May 1929.

The work of the Kala-azar Commission during 1928 consisted chiefly in systematic attempts to transmit the disease to man by means of the

bites of *Phlebotomus argentipes*, Ann. & Brun. No results have yet been obtained. Out of 200 examples of this sandfly taken in infected houses, 7 were found to contain a flagellate morphologically identical with *Leishmania donovani*. Other investigations mentioned have already been noticed [*R.A.E.*, B, xvi, 249].

Bilderbeck (—). **Etude sur les puces du rat dans la zone du Port de Rangoon.**—*Bull. Off. int. Hyg. publ.*, xxi, fasc. 4, pp. 582–585. Paris, April 1929.

From 5th January to 30th June 1928 an investigation on the rat fleas of Rangoon was carried out by G. G. Jolly. A list is given of the species of rats and other small mammals examined with notes on their seasonal distribution. Of a total of 12,744 fleas caught, 96·4 per cent. were *Xenopsylla astia*, Roths., and 3·6 per cent. *X. cheopis*, Roths. A single individual of *Ctenocephalus felis*, Bch., was taken on *Mus norvegicus* (*decumanus*).

Jorge (R.). **La dengue. A propos d'une épidémie nautique dépistée à Lisbonne.**—*Bull. Off. int. Hyg. publ.*, xxi, fasc. 9, pp. 1531–1545, 18 refs. Paris, September 1929.

An account is given of an outbreak of dengue that occurred on board a vessel anchored in Lisbon harbour. The only species of mosquito found on the ship was *Culex fatigans*, Wied., and it is thought that all the cases had been contracted at Dakar, Senegal, the previous port of call, where the disease is endemic, although no epidemic was observed there at that time. The cases occurred between the fourth and tenth day of the voyage, thus coinciding with the period of incubation of the disease, which is usually 5–8 days but may be as long as 12. No cases were observed in Lisbon.

The author discusses the epidemiology of dengue and gives reasons for differentiating this disease from sandfly fever and yellow fever and for considering *Aëdes argenteus*, Poir., to be the vector.

Boyé (—). **Une épidémie de dengue en Cochinchine en 1927.**—*Bull. Off. int. Hyg. publ.*, xxi, fasc. 9, pp. 1546–1548. Paris, September 1929.

An account is given of an outbreak of dengue that occurred in Cochin China during 1927. Mosquitos did not appear to be more numerous than in the preceding years, and the epidemic began before the period of maximum prevalence of mosquitos and ended before the end of the rainy season at a period when they are very numerous. Moreover, persons using mosquito nets and those protected by clothing did not appear to be less affected than those that used no nets and wore few clothes. Cases were not more frequent in the country, where mosquitos are abundant, than in the towns, where they are relatively rare. It would thus appear that the hypothesis attributing the transmission of the disease solely to the agency of a mosquito is not in accordance with the circumstances of the outbreak in Indo-China, neither does it explain the exceptional scarcity of the disease in recent years nor its practical disappearance in 1928.

DIXEY (F.). **Annual Report of the Geological Survey Department, Nyasaland Protectorate, for the Year 1926.**—Fol., 6 pp. Zomba, Govt. Printer. [1927.]

Included in this report is a report of the geologist on the Dowa district, where it is necessary, in order to check the southward spread of the tsetse-fly [*Glossina morsitans*, Westw.], to throw a barrier across the line of its advance, consisting of a cleared and cultivated strip of land a mile wide. The supply of water for this barrier zone is discussed, as villages will have to be removed from the adjacent fly-infested area and re-established along the barrier.

CHORLEY (J. K.). **Experiments in Grass Fires against *Glossina morsitans* in Southern Rhodesia.**—*Bull. Ent. Res.*, xx, pt. 4, pp. 377–390, 4 refs. London, December 1929.

Several investigators have advocated the use of late, organised grass fires as a method of controlling tsetse-flies in various parts of Africa [*R.A.E.*, B, ix, 97 ; xv, 167], and the investigations described in detail in this paper were undertaken in 1927 and 1928 in the Lomagundi fly-belt with a view to determining the efficacy of this method in the control of *Glossina morsitans*, Westw., in Southern Rhodesia.

The following is taken from the author's summary : As a result of the burning, the adult fly concentrated along the shady watercourses and other parts of the forest where the fires were less fierce and the requisite shade was to be found. No immediate effect on the puparia was noticed. The number of dead puparia collected increased during October and November, but this is considered to be attributable to the lethal effects of the sun, not of the fire. The effect of the burning on the flora and game is described. The pupal period of the fly decreases from 82 days for puparia collected in June to 21 days for those collected in November. The period of greatest activity of the fly, as indicated by emerging flies, density and collected puparia, is in September. On an average 11 per cent. of the flies were infected with *Trypanosoma congolense* and *T. vivax* in the proportion of ten to seven. Only one infection of the salivary gland (by *T. brucei*) was found in 1,523 dissections. There is a tendency for the percentage of infected flies to increase during the late dry season when the visibility of the game also increases. The food of the fly consisted almost entirely of mammalian blood (only one fly contained avian blood), and examination of their fat content failed to indicate any degree of starvation.

WIGGLESWORTH (V. B.). **Observations on the " Furau " (Cicindelidae) of Northern Nigeria.**—*Bull. Ent. Res.*, xx, pt. 4, pp. 403–406, 1 fig., 6 refs. London, December 1929.

An account is given of observations and experiments on the feeding habits of the Cicindelid larvae, known in Nigeria as " Furau," which are believed to bite the feet of man, causing inflammatory lesions. The larvae were fed on termites and other insects, and digestion was found to be mainly extra-intestinal. A dark brown slightly acid fluid, which is actively proteolytic and causes blackening of the tissues, is ejected from the intestine of the larva and dissolves the tissues of the prey.

The bites of the larvae had no effect on the skin of a monkey or of man, and there is little doubt that the larvae have no relation to the lesions, which are also called " Furau," in Northern Nigeria.

JOHNSON (M. S.) & MUNGER (F.). **Observations on excessive Abundance of the Midge** *Chironomus plumosus* **at Lake Pepin.**—*Ecology*, xi, no. 1, pp. 110–126, 2 figs., 23 refs. Brooklyn, N.Y., January 1930.

An account is given of observations on the bionomics of *Chironomus plumosus*, L., which has been recorded for some years as breeding in Lake Pepin, an expansion of the Mississippi between Minnesota and Wisconsin, in such numbers as to cause serious annoyance.

Sheep Tick and Sheep Lice.—*J. Dept. Agric. Victoria*, xxvii, pt. 10, pp. 609–616, 4 figs., 3 diagr. Melbourne, October 1929.

An account is given of the bionomics of the Hippoboscid, *Melophagus ovinus*, L., and of the louse, *Bovicola* (*Trichodectes*) *ovis*, L. (*sphaerocephalus*, Nitz.) in Victoria [*cf. R.A.E.*, B, vii, 120; xiii, 102, 103]. Newly shorn sheep offer little protection to the flies, and they move on to lambs and unshorn sheep. The length of the life of the adult females is from 4 to 5 months. The eggs of the louse are attached to the wool and hatch in from 5 to 10 days.

Instructions for dipping the sheep and diagrams of dipping tanks and pens are given.

PAPERS NOTICED BY TITLE ONLY.

LEPRINCE (J. A.) & JOHNSON (H. A.). **A new Method for mechanical Distribution of Paris Green as an Anopheline Larvicide : Preliminary Report.**—*Southern Med. J.*, xxii, no. 4, pp. 372–374, 1 ref. Birmingham, Ala., April 1929. [*Cf. R.A.E.*, B, xvii, 170.]

BARBER (M. A.), KOMP (W. H. W.) & NEWMAN (B. M.). **The Effect of small Doses of Plasmochin on the Viability of Gametocytes of Malaria as measured by Mosquito Infection Experiments.** *Pub. Hlth. Rep.*, xliv, no. 24, pp. 1409–1420, 12 refs. Washington, D.C., 14th June 1929. [See *R.A.E.*, B, xvii, 246.]

LEMAIRE (E.). **La systématique des** *Anopheles* **paléarctiques adultes par leurs caractères macroscopiques.**—*Rev. Méd. Hyg. trop.*, xxii, no. 1, pp. 32–34. Paris, 1930.

FALKNER (H. J.). **Culicidae of the Torquay District.**—*Trans. Proc. Torquay Nat. Hist. Soc.*, v, no. 2, pp. 141–143. Torquay, 1928.

DE BUCK (A.), SCHOUTE (E.) & SWELLENGREBEL (N. H.). **Zur Kenntnis des Anophelismus ohne Malaria in dem Küstengebiet der Niederlande.** [A Review of Studies on the Occurrence of *Anopheles* in the Absence of Malaria in the coastal Region of Holland.]—*Arch. Schiffs- u. Tropenhyg.*, xxxiii, no. 12, pp. 619–631, 3 figs., 13 refs. Leipzig, December 1929. [*Cf. R.A.E.*, B, xvii, 178, etc.]

Swellengrebel (N. H.), Swellengrebel de Graaf (J. M. H.) & de Buck (A.). **Le paludisme aux Pays-Bas, contracté en automne, ne se manifeste que pendant l'été suivant.**—*Bull. Soc. Path. exot.*, xxii, no. 8, pp. 642–645, 1 diagr. Paris, 1929. [*Cf. R.A.E.*, B, xviii, 52.]

de Boissezon (P.). **Sur l'histologie et l'histophysiologie de l'intestin de la larve de** *Culex pipiens* **L.**—*C.R. Soc. Biol.*, ciii, no. 8, pp. 567–568. Paris, 28th February 1930.

de Boissezon (P.). **Sur l'histologie et l'histophysiologie de l'intestin de** *Culex pipiens* **L. (imago) et en particulier sur la digestion du sang.**—*C.R. Soc. Biol.*, ciii, no. 8, pp. 568–570. Paris, 28th February 1930.

Kudo (R.). **Studies on Microsporidia parasitic in Mosquitoes. vii. Notes on Microsporidia of some Indian Mosquitoes.**—*Arch. Protistenk.*, lxvii, no. 1, pp. 1–10, 1 pl., 22 refs. Jena, 23rd August 1929.

Kudo (R.). **Studies on Microsporidia parasitic in Mosquitoes. viii. On a Microsporidian,** *Nosema aedis* **nov. spec., parasitic in a Larva of** *Aëdes argenteus* (*aegypti*) **of Porto Rico.**—*Arch. Protistenk.*, lxix, no. 1, pp. 23–38, 2 pls., 47 refs. Jena, 15th January 1930.

Montschadsky (A.). **Die Stigmalplatten der Culiciden-Larven. Eine systematische Studie.** [The Stigmal Plates of Culicid Larvae. A systematic Study.]—*Zool. Jahrb.*, Abt. Syst., lviii, no. 5–6, pp. 541–636, 7 pls., 3 figs., 40 refs. Jena, 15th January 1930.

Dubovsky (N.). **Ueber die systematische Stellung von** *Aëdes* (*Ochlerotatus*) *behningi* **Martini.** [On the systematic Position of *A. behningi*.]—*Zool. Anz.*, lxxxvi, no. 7–8, pp. 179–184, 1 fig., 3 refs. Leipzig, 15th January 1930.

Pittaluga (G.). **Las especies españolas del género "** *Phlebotomus* **" y su importancia epidemiológica.** [The Spanish Species of *Phlebotomus* and their epidemiological Importance.]—*Rev. chil. Hist. nat.*, xxxiii, pp. 405–413. Santiago, Chile, 1929. [See *R.A.E.*, B, xv, 34.]

Phillips (J.). **Research on Tsetse Fly Control in Africa** [Tanganyika Territory].—*Ecology*, x, no. 3, pp. 359–360. Brooklyn, N.Y., July 1929. [*Cf. R.A.E.*, B, xviii, 61.]

Moutia (A.). *Stomoxys nigra* **Macq.**—*Rev. agric. Ile Maurice*, no. 38, pp. 88–89. Mauritius, March–April 1928. [*Cf. R.A.E.*, B, xvii, 20.]

Jobling (B.). **A comparative Study of the Structure of the Head and Mouth Parts in the Streblidae (Diptera Pupipara).**—*Parasitology*, xxi, no. 4, pp. 417–445, 3 pls., 6 figs., 14 refs. Cambridge, November 1929.

Kröber (O.). **Nachträge zu den kleinen Gattungen der südamerikanischen Tabanini.** [Supplement to the minor Genera of the South American Tabanini.]—*Zool. Anz.*, lxxxvi, no. 9–10, pp. 248–265, 8 figs. Leipzig, 1st February 1930. [*Cf. R.A.E.*, B, xvii, 184.]

Kröber (O.). **Die Tabanidenuntergattung** *Phaeotabanus* **Lutz.** [The Tabanid Subgenus *Phaeotabanus*.]—*Zool. Anz.*, lxxxvi, no. 11–12, pp. 273–300, 21 figs. Leipzig, 10th February 1930.

Kröber (O.). **Die Untergattungen** *Macrocornus* **Lutz und** *Chlorotabanus* **Lutz.** [The Subgenera *Macrocornus* and *Chlorotabanus*.]—*Zool. Anz.*, lxxxvii, no. 1–2, pp. 1–18, 13 figs. Leipzig, 15th February 1930.

Buchmann (W.). **Untersuchungen über die Ernährungsphysiologie der Dipterenlarven. 2. Teil. Die Histophysiologie der Resorption.** [Investigations on the Physiology of Nutrition of Dipterous Larvae. Part 2. Histophysiology of Resorption.]—*Z. Desinfekt.*, xxii, no. 1, pp. 6–30, 12 figs., 24 refs. Dresden, January 1930. [*Cf. R.A.E.*, B, xviii, 64.]

Del Ponte (E.). **Algunas especies nuevas del gen.** *Triatoma* **Lap.** [Six new Species of *Triatoma* from South America; hosts not recorded.]—*Bol. Soc. ent. argent.*, i, no. 4, pp. 3–8, 1 pl. Buenos Aires, 30th November 1929.

Thiroux [A.]. **La peste à Madagascar, de juillet 1923 à juillet 1928.**—*Bull. Off. int. Hyg. publ.*, xxi, fasc. 4, pp. 601–611, 2 diagrs. Paris, April 1929. [See *R.A.E.*, B, xvii, 202.]

Sorel (—) & Armstrong (—). **La lutte préventive contre la peste dans la circonscription de Dakar et dépendances durant l'année 1928.**—*Bull. Off. int. Hyg. publ.*, xxi, fasc. 4, pp. 612–618. Paris, April 1929. [See *R.A.E.*, B, xvii, 202.]

Sugimoto (M.). **Studies on Mallophaga attacking domestic Birds in Formosa.** [In Japanese, with Descriptions of two new Varieties in English.]—*Rep. Dept. Agric. Res. Inst. Formosa*, no. 43, pp. 1–59, 19 pls. Taihoku, October 1929.

Schulze (P.). **Erster Beitrag zu einer Zeckenfauna Dänemarks.** [A First Contribution to a Tick Fauna of Denmark.]—*SitzBer. Abh. naturf. Ges. Rostock*, (3) ii, (1927–29) pp. 120–123, 1 pl., 3 refs. Rostock, 10th January 1930.

Weber (H.). **Biologische Untersuchungen an der Schweinelaus (*Haematopinus suis* L.), unter besonderer Berücksichtigung der Sinnesphysiologie.** [Biological Investigations on *H. suis*, with special Regard to the Physiology of the Senses.]—*Z. vergl. Physiol.*, ix, pp. 564–612, 21 figs. (Abstract in *Zbl. Bakt.*, (2) lxxix, no. 23–26, p. 520. Jena, 31st December 1929.)

Hecht (O.). **Die Hautreaktionen auf Insektenstiche als allergische Erscheinungen.** [Skin Reactions to Insect Bites as allergic Phenomena.]—*Beih. Arch. Schiffs- u. Tropenhyg.*, xxxiii, no. 3, pp. 364–366. Leipzig, 1929.

Hecht (O.). **Ueber Insektenstiche.** [Skin Reactions to the Bites of Blood-sucking Insects.]—*Dermatol. Wschr.*, lxxxviii, no. 23, pp. 793–848, 6 figs., 2 pp. refs. Leipzig, 8th June 1929.

Stiles (C. W.) & Hassall (A.). **Key-catalogue of Parasites reported for Primates (Monkeys and Lemurs) with their possible Public Health Importance . . .** and Stiles (C. W.) & Nolan (M. O.). **Key-catalogue of Primates for which Parasites are reported.**—*Hyg. Lab. Bull.*, no. 152, pp. 409–601. Washington, D.C., U.S. Public Hlth. Serv., 1929. Govt. Ptg. Off., 35 cents.

BISHOPP (F. C.). **The Pigeon Fly—an important Pest of Pigeons in the United States.**—*J. Econ. Ent.*, xxii, no. 6, pp. 974–980. Geneva, N.Y., December 1929.

Pseudolynchia maura, Bigot, became especially troublesome as a pest of pigeons in 1927 and 1928 in many parts of the United States, particularly in the south. An account is given of studies on its life-history and control in 1929. The distribution of this Hippoboscid is discussed. In addition to many breeds of domestic pigeons, *P. maura* has been recorded on a ring dove in Nyasaland and on an owl, *Strix flammea*, in Portuguese East Africa. The flies frequently bite man, but it is not known whether they can live continuously or reproduce when fed on human blood. Young pigeons become infested as soon as they are sufficiently feathered to afford protection to the flies, as many as 20 or 30 being found on a single bird. *Haemoproteus columbae*, the causal organism of pigeon malaria, which is transmitted by this fly, was found in the vicinity of Washington, D.C. The unrestricted shipment of pigeons between various countries and the ease with which the organisms are transmitted make it probable that the disease is coextensive with the insect. Pigeon malaria does not produce marked symptoms in the birds, though their condition is probably lowered, especially at the time of the initial attack.

The flies spend the greater part of their lives among the feathers of the birds, their distribution on older birds being general and on younger ones more concentrated around the bases of the wings and tail. They occasionally fly from the host and alight on some adjacent object. Mating and deposition of the pupae take place on the birds, and the pupae are thus largely concentrated in the nests. A brief description of the pupa and the emergence of the adult is given. The pupal stage lasts 29–31 days at a mean temperature of 73° F. Thorough cleaning of the pigeons' nests at intervals not exceeding 25 days is recommended, in order to destroy the pupae before the flies have had time to emerge. The pupae are very resistant to most insecticides, but dipping in a concentrated extract of 5 lb. pyrethrum flowers to 1 U.S. gal. kerosene gave 100 per cent. mortality. Some of the pupae dropped in the yards may be killed by contact with moist soil. Nesting material may safely be used as a fertiliser if ploughed under promptly to a depth of 4 inches, from which the emerging flies cannot escape. The manure may be stored in fly-proof bins, and the adults caught as they emerge in cone fly-traps.

Among insecticides tested on young and adult pigeons, one to three pinches of pyrethrum powder scattered among the feathers killed all flies present. A high percentage of mortality was also secured with derris or tobacco powder containing about 6 per cent. nicotine. A dip consisting of aqueous extract of pyrethrum, soap and water killed all the flies, as did two proprietary extracts of derris root. Nicotine sulphate, 1 : 100, gave a high percentage of mortality, and with addition of 1 oz. soap to 1 U.S. gallon of water destroyed all flies. Painting the nests and boxes with nicotine sulphate killed many flies, but was injurious to the pigeons. Kerosene extract of pyrethrum used as a light spray kills the flies in buildings and on birds, but an excessive quantity injured the skin and eyes of young pigeons. Birds should be dusted with pyrethrum powder before shipping or on receipt of a new consignment to prevent transmission to uninfested lofts.

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No parasites have been obtained from the puparia of *P. maura*, but a Sarcoptid mite was found in numbers attached to the flies in Florida. Infestations die out in the northern States during the winter, but during the summer and autumn flies introduced on stock shipped from the South in the spring may increase to troublesome numbers.

Bourgault-Ducoudray (L.). **Un piège à mouches.**—*Rev. agric. Ile Maurice*, no. 41, pp. 215–218. Mauritius, September–October 1928.

In Mauritius, where very heavy losses occur among cattle and surra is rife every year, the author has devised a trap for *Stomoxys* [*nigra*, Macq.] which has given very good results. It consists of a building with passages through which the cattle are driven. After making a sharp turn the animals pass through a screen formed of interlaced branches and foliage, which sweeps all the flies off them. The flies leave the animals and fly to the nearest point of light, which is made to enter at this spot through a trap made of wire gauze, in which they are captured. The animals, freed from flies, continue to walk through the dark passages to the exit of the building. From 100 animals, 208,000 flies were thus captured during the first week in January, and after the second week very few flies were observed in the neighbourhood, though about 20,000 were still captured each day, presumably having freshly emerged. This method is considered particularly applicable to Mauritius, where the heat and humidity are so great for 4 or 5 months of the year that it would be impossible to disinfect or destroy all the breeding-places of *Stomoxys*, which include dung and any decomposing vegetable matter containing sufficient moisture.

Knowles (R.), Das Gupta (B. M.) & Basu (B. C.). **Preliminary Observations on the Morphology and Life-history of** *Spirochaeta anserina*.—*Trans. 7th Cong. Far East. Ass. Trop. Med. 1927*, ii, pp. 573–581, 12 refs. Calcutta [1929].

Spirochaetosis of fowls, caused by *Spirochaeta anserina*, is known to occur in northern and central India, but in Calcutta the authors found no trace of the spirochaete in poultry from the bazaars, or in *Argas persicus*, Oken, which infests the fowl runs and is its principal vector. The experiments described in the present paper were carried out with individuals of *A. persicus* obtained from a fowl bazaar in Calcutta, and a strain of *S. anserina* from another part of the country. The developmental cycle of the spirochaete in the vertebrate and invertebrate hosts is described. Infection is normally transmitted by the saliva and bite of the tick, but occasionally the secretion of the coxal glands is also infective. Motile spirochaetes were seen in the salivary glands of *A. persicus* from 6 to 31 days after an infective feed, and the bite of a tick was found to be infective on the seventh day. In fowls inoculated with infective blood, the incubation period is nearly always 24 hours, although occasionally the spirochaetes do not appear in the blood for 48 hours ; they multiply rapidly in the blood, but usually persist in it

for only one or two days. Hereditary transmission of *S. anserina* by *A. persicus* is known to occur. The authors found motile spirochaetes in the ovaries of 3 out of 66 fed female ticks examined, and they consider it probable that the eggs become infected before fertilisation and oviposition.

MORGAN (W. L.). *Alysia manducator* **Pz. An introduced Parasite of the Sheep Blowfly Maggot.**—*Agric. Gaz. N.S.W.*, xl, pt. 11, pp. 818–829, 3 figs., 4 refs. Sydney, November 1929.

Notes are given on the attempts to introduce *Alysia manducator*, Panz., for the control of sheep blow-flies in New South Wales. Much of the information on the life-history of this Braconid has been previously noticed [*R.A.E.*, B, viii, 218; xv, 82]. All stages are described and figured. Adults were able to emerge from pupae buried in the soil to a depth of several inches. The process of oviposition is described. In observations on 33 females, the average progeny was 75 and the maximum 250. Kerosene tins with the top cut away to leave a one inch flange round the opening to prevent the blowfly larvae from escaping, and containing soil 6 to 8 ins. deep, were used for breeding *A. manducator*. Rabbits' heads containing the larvae were suspended in the tins and exposed to the parasites. The parasitised larvae burrowed into the soil to pupate, the parasites being thus protected from the Chalcid, *Mormoniella vitripennis*, Wlk. (*brevicornis*, Ashm.). The contents of the tins were not disturbed until all the flies from the unparasitised pupae had emerged. The parasitised pupae were then separated by floating them off in water and were placed in glass-topped boxes and covered with fine soil one inch deep.

Seven complete and two partial generations of *A. manducator* were reared in the laboratory from about May 1928 till September 1929. Mating took place more readily in small glass tubes (4 by $\frac{3}{4}$ ins.) in the sunlight, than in larger containers. The average length of the life-cycle in the insectary was 35 days in the summer, 45 in the autumn, and 65 in the winter. In the laboratory the parasites were bred from the smooth-bodied larvae of *Calliphora* spp. and *Lucilia sericata*, Mg., the best results being obtained with the latter and *C. erythrocephala*, Mg. Only one was reared from the larvae of *Chrysomyia albiceps*, Wied. (*rufifacies*, Macq.), the parasites being usually unable to pierce the cuticle of the larvae with the ovipositor. In the field, however, oviposition in full-grown maggots of *C. albiceps* appeared to be more easily accomplished. Altogether 6,000 individuals of *A. manducator* have been released in various localities in New South Wales, but its establishment may be rendered difficult by various factors such as the dry character of the climate, particularly as affecting the soil, and the activity of *M. vitripennis* [xvii, 118] and various predacious beetles.

MYERS (J. G.). **Facultative Blood-sucking in Phytophagous Hemiptera.**—*Parasitology*, xxi, no. 4, pp. 472–480, 27 refs. Cambridge, November 1929.

This is a review from the literature of records of phytophagous Rhynchota attacking man and includes an instance of the author being bitten by *Lygus pratensis*, L.

Hase (A.). **Weitere Versuche zur Kenntnis der Bettwanzen** *Cimex lectularius* **L. und** *Cimex rotundatus* **Sign. (Hex.-Rhynch.). Beiträge zur experimentellen Parasitologie 4.** [Further Investigations on *C. lectularius* and *C. hemiptera*. Contributions to experimental Parasitology 4.]—*Z. Parasitenk.*, ii, no, 3, pp. 368–418, 9 figs., 2 pp. refs. Berlin, 25th January 1930.

Experiments showed 30° C. [86° F.] to be the optimum temperature for hatching the eggs of *Cimex hemiptera*, F. (*rotundatus*, Sign.), 92·5 per cent. yielding larvae, whereas 25° C. [77° F.] and 30° C. [86° F.] gave equally good results (95·1 per cent.) with those of *C. lectularius*, L. In no case did all the eggs hatch. Exposure to a temperature of −15° C. [5° F.] killed all the eggs of the former and 76 per cent. of those of the latter. After eggs of *C. lectularius* had been kept for 35 days at 2° C. [35·6° F.], about 5 per cent. hatched. A method of breeding bedbugs on mice, and thus obtaining a constant supply for laboratory use, is described.

[Dryenski (P.).] Drenski (P.). **Die in Bulgarien lebenden Wanzenarten (Fam. Cimicidae Hem.) und die Mittel zur Bekämpfung derselben.** [Species of Bugs in Bulgaria and Measures for their Control. (*In Bulgarian.*)]—*Trav. Soc. bulg. Sci. nat.*, no. 13, pp. 63–96, 3 figs., 8 refs. Sofia, 1928. (With a Summary in German.) [Recd. January 1930.]

A detailed account is given of observations on the bionomics of Cimicid bugs, carried out in 1926–28 in Sofia and its environs. Keys to the genera *Oeciacus*, Stål, and *Cimex*, L., and to the species *O. hirundinis*, Jen., *C. lectularius*, L., *C. columbarius*, Jen., and *C. pipistrelli*, Jen., are given. *C. lectularius*, all stages of which are described, is very abundant all over the country. Eggs are laid in cracks, etc., each female laying 45–55 in about 7 months. No oviposition takes place when the adults lack food, or at a temperature below 12° C. [53·6° F.] or above 40° C. [104° F.]. Moisture decreases the activity of the bugs. Eggs submerged in water at a temperature of 35–37° C. [95–98·6° F.] were killed in a short time, but were more resistant in cold water. The adults are not killed by a temperature of even −30° C. [−22° F.]. All stages are killed in 24 hours at 40° C. [104° F.] and instantaneously at 45° C. [113° F.]. *C. lectularius* attacks man, poultry, dogs, cats, mice and other animals.

Possible means of control are briefly reviewed and include the protection of natural enemies of the bugs, such as *Chelifer*, *Scutigera* and spiders of the genus *Teutana*. The use of insecticides is discussed, and it is pointed out that fumigation would be the best method, but has so far not been practised in Bulgaria. Hydrocyanic acid gas at a concentration of 0·1–0·2 per cent. kills all stages in 24 hours.

Of the other bugs, *C. pipistrelli* probably infests cave bats, *C. columbarius* is common in fowl-houses, and *O. hirundinis* in nests of swallows and house-martins. The last two species are recorded for the first time in Bulgaria. *O. hirundinis* often enters houses at night and after engorging on man returns to the swallows' nests, in which it also hibernates.

[Nikanorov (S. M.).] Nikanoroff (—). **La peste au sud-est de l'Union des Républiques Soviétistes Socialistes.**—*Bull. Off. int. Hyg. publ.*, xx, fasc. 4, pp. 537–564, 1 map, 4 diagrs. Paris, 1928.

An account is given of plague in South-east Russia [*cf. R.A.E.*, B, xviii, 25]. The author records the case of a man who, although healthy himself, was apparently responsible for the infection of several people with plague and was found to harbour plague bacilli.

Markianos (J.). **Le rôle des poux dans la transmission de la lèpre.**—*Bull. Soc. Path. exot.*, xxii, no. 8, pp. 633–635. Paris, 1929.

Experiments on the transmission of leprosy from infected to healthy rats by means of lice showed that whereas the disease was not transmitted by lice migrating naturally from dead infected animals to healthy ones, or by ingestion of liquid containing crushed lice from an infected rat, subcutaneous inoculation with a portion of the same liquid produced infection in each of three cases.

Schwetz (J.) & Collart (A.). **Notes protozoologiques. Spirochètes sanguicoles chez** *Cobus vardoni* **et** *Gonderia mutans* **chez** *Cobus ellipsiprymnus* **et chez** *Ourebia hastata.*—*Bull. Soc. Path. exot.*, xxii, no. 8, pp. 651–656, 3 figs., 5 refs. Paris, 1929.

Blood parasites found on examination of 19 antelope killed in the Belgian Congo at the beginning of 1929 included *Trypanosoma congolense* in one out of eleven individuals of *Cobus vardoni* and *Theileria* (*Gonderia*) *mutans* in all of six individuals of *C. ellipsiprymnus* and each of two individuals of *Ourebia hastata*. Two unidentified nymphs of ticks were found on one *Ourebia* and numerous individuals of *Rhipicephalus appendiculatus*, Neum., on the two species of *Cobus*.

Schwetz (J.) & Geerinck (—). **Sur quelques parasites sanguicoles des rongeurs de Stanleyville (Congo belge).** *Trypanosoma lewisi*, *Grahamella* **et** *Toxoplasma* (*?*).—*Bull. Soc. Path. exot.*, xxii, no. 8, pp. 657–661, 1 fig. Paris, 1929.

Blood parasites of rodents found in the vicinity of the laboratory near Stanleyville, Belgian Congo, included *Trypanosoma lewisi* in adults of *Mus rattus*, the only species of rat found in this region. Fleas were relatively rare, but *Xenopsylla cheopis*, Roths., was taken on *M. rattus*.

Carpentier (G.). **Note au sujet d'une affection humaine signalée à Firouzkouh (Perse).**—*Bull. Soc. Path. exot.*, xxii, no. 8, pp. 677–679. Paris, 1929.

Notes are given on a disease that occurs in Persia 3–5 days after the bite of a parasite. The author considers that it is probably a form of tick-borne spirochaetosis, the vector of which is an Ixodid, probably of the genus *Ornithodorus*, that is common in the poorer dwellings.

DE BOISSEZON (P.). **Expériences au sujet de la maturation des oeufs chez les Culicides.**—*Bull. Soc. Path. exot.*, xxii, no. 8, pp. 683–689, 1 ref. Paris, 1929.

During the winter of 1929 *Culex pipiens*, L., was found breeding in a cellar in France at a temperature of 16° C. [60·8° F.], although there was no animal or vegetable nourishment for the adults, unless they obtained it from the more or less dirty water of the holes in which the larvae were found. Experiments showed that reproduction was possible when only distilled water or water from the breeding holes was available for the nourishment of ovipositing females, that such reproduction is possible at temperatures of 20–26° C. [68–78·8° F.], and that although nourishment is not indispensable for the maturation of eggs, mosquitos fed on slices of apple oviposited regularly [*R.A.E.*, B, xviii, 9], whereas in these experiments oviposition rarely took place, and the batches contained very few eggs. It was therefore concluded that the females must carry over from their larval stage a sufficient reserve of nutritive substances for the maturation of their eggs.

Experiments were undertaken to verify this hypothesis, and it was found that females from larvae that had fed on an abundance of protein laid eggs regularly and in larger numbers than in the previous experiments, although they were completely deprived of nourishment in the adult state. Adults deprived of nourishment only lived for about ten days, whether they had oviposited or not, and it would seem that in general the females that have not taken a blood meal live scarcely longer than the time necessary for the maturation of their eggs. Two females that had taken a meal of centrifuged blood serum lived for two months and three months respectively.

BÉROS (G.) & BALOZET (L.). **Fièvre exanthématique d'été au Maroc.**—*Bull. Soc. Path. exot.*, xxii, no. 8, pp. 712–728, 22 refs. Paris, 1929.

An account is given of an exanthematic fever occurring at Casablanca, Morocco, during the summer of 1929, that seems to be identical with Marseilles fever [*R.A.E.*, B, xvii, 253]. The vector appears to be a tick; six of the infected patients felt bites, and a female of *Rhipicephalus sanguineus*, Latr., was taken from one of them. All cases had been in close contact with dogs, which harbour only *R. sanguineus* in Morocco and are probably the preferred host of this species, but blood from an infected person inoculated into a dog did not produce the disease, and there is nothing to suggest that the dog is a reservoir. No lice were found on infected persons or in their vicinity.

EWING (H. E.). **Notes on the Lung Mites of Primates (Acarina : Dermanyssidae), including the Description of a new Species.**—*Proc. Ent. Soc. Wash.*, xxxi, no. 7, pp. 126–130, 8 refs. Washington, D.C., October 1929.

A new species of lung mite, *Pneumonyssus congoensis*, is described from a baboon (*Papio* sp.) in the Belgian Congo. A key is given including this species and *P. duttoni*, Newst. & Todd, from *Cercopithecus schmidtii*, *P. griffithi*, Newst., from *Macacus rhesus*, and *P. simicola*, Banks, from *Cynocephalus* sp. Two other lung mites have been described, both from *M. rhesus*, but the author considers their status uncertain.

Quarantine Proclamation, no. 198.—*Commonw. Australia Gaz.*, no. 112, reprint 1 p. Melbourne, 5th December 1929.

As from 4th December 1929, the removal of live poultry from the Territory of North Australia into any other part of the Commonwealth is prohibited, unless certified to be free from *Echidnophaga gallinacea*, Westw., and to be from uninfested premises and forwarded in new receptacles.

Imms (A. D.). **A General Textbook of Entomology.**—Roy. 8vo, xii+703 pp., 607 figs., refs. London, Methuen & Co. Ltd., 2nd edn. revd., 1930. Price, 36*s*.

This second edition [*cf. R.A.E.*, B, xiii, 56] contains various additions and emendations, the most important being revised classifications of the orders Dermaptera, Isoptera and Thysanoptera, additions to the bibliographies at the end of many of the chapters, and notes on recent advances in the subject in the form of addenda.

Takahashi (R.). **An Aphid that stings Man.** [*In Japanese.*]—*Trans. Nat. Hist. Soc. Formosa*, xx, no. 106, pp. 43–44. Taihoku, 1930.

Astegopteryx styracicola, Tak., is an Aphid that produces galls on *Styrax* in Formosa, and the apterous females often leave the galls and crawl over them and on the branches. When disturbed, they drop to the ground, and if they come in contact with the face or hands, they pierce the skin with the rostrum, causing eruptions, which, however, disappear after some days.

Marcovitch (S.) & Stanley (W. W.). **Cryolite and Barium Fluosilicate : their Use as Insecticides.**—*Bull. Tennessee Agric. Expt. Sta.*, no. 140, 19 pp., 8 figs., 5 refs. Knoxville, Tenn., November 1929.

In the course of experiments discussed elsewhere [*R.A.E.*, A, xviii, 222], it was found that barium fluosilicate and synthetic cryolite, 1 : 100 cc., killed 50 per cent. of the larvae of *Culex fatigans*, Wied. (*quinquefasciatus*, Say) in 55 and 155 minutes respectively.

[Simanin (P. I.).] **Симанин (П. И.). Contributions à la faune des Culicides du Ferghana.** [*In Russian.*]—*C.R. Acad. Sci. U.R.S.S.*, 1929, no. 22, pp. 503–506, 1 fig., 5 refs. Leningrad, 1929.

Notes are given on the seasonal occurrence and local distribution of 12 species of mosquitos collected in Ferghana in the summer of 1928, including the following Anophelines : *Anopheles bifurcatus*, L., *A. hyrcanus*, Pall., *A. hyrcanus* var. *pseudopictus*, Grassi, *A. hyrcanus* var. *mesopotamiae*, Christ., *A. pulcherrimus*, Theob., *A. superpictus*, Grassi, and *A. sacharovi*, Favr, which the author considers to be a subspecies of *A. maculipennis*, Mg.

From an examination of the genitalia of 350 males of *A. sacharovi* and of 150 of *A. hyrcanus* var. *pseudopictus*, the author concludes that the presence of additional spines on the side piece is only a matter of individual variation, and that both *A. relictus*, Shing., and *A. alexandrae-shingarevi*, Shing. [*R.A.E.*, B, xvi, 200] are synonyms of *A. sacharovi*.

Speedy (W. D.) & Adhikari (A. K.). **A Record of Malarial Cases in the Bengal-Nagpur Railway Construction Hospital, Titlagarh, from July 1928 to August 1929, with some Observations on Mosquito Findings and Conditions of Transmission.**—*Indian Med. Gaz.*, lxiv, no. 11, pp. 629–631. Calcutta, November 1929.

In this locality in central India, malaria is prevalent from July to September, and few fresh cases occur after December. The chief Anopheline is *Anopheles culicifacies*, Giles, which breeds in collections of fresh rainwater in uncultivated fields and later in rice-fields. The greater part of the breeding ceases by September. The author suggests that the practical cessation of cases of infection after December is probably due to the fact that the length of the life of the adult mosquitos is about three months and that the conditions of temperature from late November to late February and of humidity in the dry hot period of April–June are inimical to the development of sporozoites in them.

Antimalarial Measures.—*Brit. Med. J.*, no. 3610, p. 518. London, 15th March 1930.

In this letter to the editor, it is stated that prior to 1926 no attempts had been made in India to screen barracks against mosquitos, as it was thought too expensive ; moreover, it was supposed that it would make them too hot to be inhabited. In that year, however, the infantry barracks in two military stations in the Punjab that had had a very high malarial incidence in 1925 were mosquito-proofed with wire-gauze [*R.A.E.*, B, xvi, 66, 246]. Such screened barracks were found cooler than unscreened ones, particularly because the need for mosquito-nets was avoided and the punkah could swing close down over the sleepers. As a result the malarial incidence fell 50 per cent. in 1927 and 1928. The improvement is reported to be continuing, and new military buildings in malarial districts in India are to be screened.

Huff (C. G.). **The Effects of Selection upon Susceptibility to Bird Malaria in *Culex pipiens* Linn.**—*Ann. Trop. Med. Parasit.*, xxiii, no. 4, pp. 427–439, 2 pls., 2 figs., 8 refs. Liverpool, 31st December 1929.

An account is given of a study carried out with *Plasmodium cathemerium* and *Culex pipiens*, L., to determine whether the immunity previously observed in certain individual mosquitos from bird malaria [*R.A.E.*, B, xvi, 61] is hereditary or whether the decisive factors are environmental. The results, which are tabulated, indicate that selection from uninfected mothers tends to effect a reduction in the percentage of individuals in the progeny that will become infected ; and that selection from infected mothers rapidly increases the percentage of individuals susceptible to infection. The proof that susceptibility and non-susceptibility behave as hereditary characters within a species suggests the possibility of a so-called susceptible species engendering a non-susceptible race, and, conversely, of the production by a so-called non-susceptible race of a susceptible one. If similar conditions obtain in human malaria, a possible explanation is offered of the innocuousness in a malarious district of a species that is a dangerous carrier of malaria in another district.

EVANS (A. M.). *Aëdes* (*Aëdimorphus*) *apicoannulatus* **Edwards and Yellow Fever : a Correction.**—*Ann. Trop. Med. Parasit.*, xxiii, no. 4, pp. 521–522, 5 refs. Liverpool, 31st December 1929.

From examination of specimens it appears certain that the Nigerian mosquito referred to by Bauer as experimentally transmitting yellow fever under the name of *Aëdes* (*Aëdimorphus*) *apicoannulatus*, Edw. [*R.A.E.*, B, xvi, 235] is in fact *A. occidentalis*, Evans [xiv, 64]. Both species occur in Sierra Leone, but whereas *A. occidentalis* is uncommon in Freetown in comparison with *A. apicoannulatus*, material identified by other workers from Nigeria and the Gold Coast has invariably been found to be the former. These two species have been confused in the literature since 1917.

It has subsequently been discovered, however, that the name *occidentalis* is preoccupied by the Australian *Aëdes occidentalis*, Skuse. *A. stokesi*, n.n., is therefore proposed for the West African species.

KENNEDY (J. T.). *Glossina morsitans* **in Relation to a Rinderpest Epizootic, West Nile District.**—18 pp., 1 map. Entebbe, Uganda, Vet. Dept., 1929.

In the lowlands of the West Nile district of Uganda, west of the Albert Nile, both game (particularly buffalo) and *Glossina morsitans*, Westw., were numerous and widely distributed before the rinderpest epizootic in 1925–26. This epizootic, which swept through the greater part of the area, greatly reduced the numbers of buffalo, and to a less extent of bush-buck and bush-pig, but other game animals were not affected.

In a recent survey, dense concentrations of *G. morsitans* were found at or soon after the end of the dry season in the valleys of four tributaries of the Albert Nile, in which there was thick cover, permanently used by resting game in the vicinity of a perennial water-supply. Apart from these concentrations, few tsetse-flies were seen, but it appears that after the rains, the growth of fresh grass, the replenishing of minor water-holes and the seasonal dispersal of the game, the fly spreads over a wide area. Along a road through an area in which there is little dense cover, and in which the concentrations of both game and fly appear to be based on occasional water-holes, a very marked decrease in the numbers of *G. morsitans* took place three months after the rinderpest epizootic, and the fly has not subsequently increased. It is suggested that in this particular area, in which both buffalo and fly were formerly very common, the decrease of the former has been more marked than elsewhere because the country is less suitable, the theory being that the rinderpest epizootic has been followed by a movement of the surviving buffalo from less suitable to more suitable localities, which are no longer overcrowded. Antelope now constitute the greater part of the large mammalian fauna in the area adjacent to the road, and they and the remaining buffalo herds move about and have no definite base. The few tsetse-flies encountered in the area were concentrated on the road itself, which indicates that they find in the road and its users a substitute for the game tracks and the game.

A factor favourable to the existence of *G. morsitans* in large bush covers permanently inhabited by game, in addition to that of food-supply, is that the grass in such places gets burned less thoroughly than

elsewhere, because it is kept closely cropped by the game and because the top shade conserves the moisture in the herbage. Buffalo, bush-buck and bush-pig differ from other game in that only rinderpest, the attack of a lion, or continued shooting drives them from a favourite stretch of dense cover; consequently a focus of tsetse based on a buffalo cover is normally assured of a permanent food-supply.

In the course of the survey it was observed that females of *G. morsitans* taken alone did not as a rule attack man so viciously as those taken where many males were present. Females were almost entirely absent in the early morning in dense concentrations of tsetse, but their numbers increased later in the day. Where *G. morsitans* was scarce, females generally constituted an unusually high proportion of the total catches, their numbers equalling or exceeding those of the males.

Grass fires appeared to have little effect on the fly, as *G. morsitans* was plentiful in one area in places where the burning had been very clean, affecting even fallen logs. The native method of cultivation, by which considerable tracts of fresh ground are broken up each year and the previously cultivated land is abandoned, is an important factor in the fly problem, since the second-growth bush is generally denser than that on virgin soil. If it could be ensured that the cultivated plots were arranged in blocks, and stumping of all trees and bush were carried out, a fly-free area, in which it would be possible to keep stock, might soon be provided where the population is at all numerous.

The highland part of the West Nile district, which was not included in the area covered by the survey, is thickly populated and well stocked, but *G. palpalis*, R.-D., is found along many of the rivers, and an outbreak of sleeping-sickness recently occurred in one locality.

SALT (G.). **Natural Control of** *Lucilia sericata*.—*Nature*, cxxv, no. 3145, p. 203. London, 8th February 1930.

Preliminary studies of the bionomics of *Lucilia sericata*, Meig., carried out at the laboratory of the Imperial Bureau of Entomology in England in connection with experiments to determine the value of the Braconid parasite, *Alysia manducator*, Panz., showed the potential rate of reproduction to be very high. The average number of eggs deposited by 8 females was 1,561·5, the most prolific of them laying 1,883. Large numbers of the eggs can be reared to the adult stage in the laboratory with a loss of only 1–2 per cent. It appears, however, that the high reproductive rate of *L. sericata* is largely neutralised in nature by its habit of laying more eggs on a carcase than the latter can support, resulting not only in the loss of surplus eggs but also in the death of larvae that would have survived had the additional eggs not been laid. When increasing numbers of eggs of the same age were placed on equal portions of meat, the size of the adults became gradually smaller, the mortality during the larval period increased, and beyond a certain point fewer adults were obtained than the amount of food was capable of supporting. Studies under field conditions carried out in September and October 1929 showed that 5,645 eggs, principally of *L. sericata*, were laid after only 5 hours' exposure in bright sunshine on a piece of meat that could not support more than 1,560 normal individuals. Oviposition continued for at least 10 days on animal remains from which numerous half-grown, starving larvae were migrating. It was then determined that from pieces of beef and whole

small mammals exposed in both sunny and shady situations, and known to have been provided with immense numbers of eggs, fewer adults were obtained than would have developed on the same food from a smaller number of eggs.

DINULESCU (G.). **Sur la présence en France du** *Gastrophilus inermis* **(Brauer).**—*C.R. Acad. Sci. Fr.*, cxc, no. 5, pp. 319–320, 4 refs. Paris, 1930.

Observations on third-stage larvae of *Gastrophilus inermis*, Brauer, in the rectum of horses killed in a slaughter house, showed no change in the larvae, except increase in size, for the first two months. During the following month, most of them accomplished the beginning of the pupal stage. When removed from the mucous membrane of the rectum and placed in dry sand at a temperature of 25–28° C. [77–82·4° F.], they continued pupal development, and the adults emerged after 21–26 days. From these and previous observations [*R.A.E.*, B, xviii, 12] the author concludes that after the first moult in the mucous membrane of the mouth, the larvae pass to the rectum, where development of the second and third instars is completed, and that on being expelled they burrow into the soil to continue pupal development. In France the adult flies are probably most numerous in July and are not found later than mid-August, corresponding with the appearance of myiasis of the cheeks in horses.

ROBERTSON (G. McR.). **Three external Parasites of Poultry.**—*Tasmanian J. Agric.*, i, no. 1, pp. 18–20. Tasmania, 1st November 1929.

Scaly leg of fowls is caused by the mite, *Cnemidocoptes* (*Sarcoptes*) *mutans*, Robin, which bores under the scales and tissues of the legs and feet, and sometimes penetrates so deeply as to cause loss of the toes or legs. The feet and legs should be soaked in warm, soapy water and then treated with equal parts of raw linseed oil and kerosene or 1 part oil of carraway to 5 parts vaseline, applied with a small hard brush three times at two days' intervals. For lice, the treatment recommended is sodium fluoride [*R.A.E.*, B, xiv, 92]. *Dermanyssus gallinae*, DeG. (*avium*, Dug.) (red mite) is the most troublesome and injurious of all pests of poultry, breeding very rapidly in cracks in the wood of fowl houses and perches. The mites attack the birds at night, and their presence is often evident only from the cast skins of the young forms on the perches. The nesting material should be removed from infested houses, and the whole place sprayed or painted with a 4 per cent. solution of some standardised coal-tar disinfectant, which should be forced into every crack.

CRAM (E. B.). **The Life History of** *Tetrameres americana* **(Cram, 1927) Baylis, 1929, a Spirurid of the Proventriculus of Chickens.**—*J. Parasit.*, xv, no. 4, p. 292. Urbana, Ill., June 1929.

Eggs of the Nematode, *Tetrameres americana*, from the glands of the proventriculus of a chicken were fed to laboratory-bred individuals of the grasshopper, *Melanoplus differentialis*, Thomas, in which they hatched, producing larvae that encysted within 42 days. Larvae were fed to young chickens 44 and 54 days after the grasshoppers had ingested the eggs, and adult Nematodes were found in the proventriculus 23, 25 and 35 days later.

Mohler (J. R.). **Report [1928–29] of the Chief of the Bureau of Animal Industry.**—62 pp. Washington, D.C., U.S. Dept. Agric., 1929.

Experiments with pigs in screened and unscreened pens in proximity to pigs infected with swine fever (hog cholera) indicated that flies or other insects that are excluded by the screens may play a part in the transmission of the disease. In Iowa, in 1927 and 1928, swine fever was most prevalent during periods when the stable fly [*Stomoxys calcitrans*, L.] was most abundant.

A disease of sheep that has caused considerable losses in southern Idaho was found to be tularaemia, transmitted by the wood tick, *Dermacentor venustus*, Banks (*andersoni*, Stiles) [*R.A.E.*, B, xvii, 130, 231]. Field observations indicate that rabbits and ground squirrels [*Citellus*], which serve as hosts for the tick during its larval and nymphal stages, are very numerous throughout the area in which the disease is prevalent. The ticks generally attach themselves to sheep in small groups on the front of the body. They can be killed effectively by a mixture of pine tar and a hydrocarbon oil applied with a paint brush; this mixture also has a repellent effect.

Further progress has been made in the eradication of the cattle tick, *Boophilus annulatus*, Say, in the Southern States, and with the release from quarantine of the remaining counties of Oklahoma, only 6 of the 15 States originally infested in 1906 remained within the quarantined area on 30th June 1929. Since infested horses and mules are frequently responsible for the spread of *B. annulatus*, these animals now receive the same consideration as cattle in the eradication areas if they are infested with ticks or exposed to infestation.

In investigations on the Nematode parasites of poultry and other birds, it was found that grasshoppers serve as the intermediate hosts of four species, *viz.*, *Tetrameres americana*, the proventricular worm of fowls and other gallinaceous birds [see preceding paper]; *Cheilospirura hamulosa*, the gizzard worm of fowls; *C. spinosa*, the gizzard worm of ruffed grouse [*Bonasa umbellus*] and bobwhite quail [*Colinus virginianus*]; and *Acuaria anthuris*, the gizzard worm of crows, which also developed in crickets. Since grasshoppers are important as bird food and are commonly eaten by fowls and turkeys, they must be considered in attempts to raise poultry free from Nematode parasites. The Coprid beetles, *Copris minutus*, Drury, and *Phanaeus carnifex*, L., were found to serve as intermediate hosts of *Gongylonema ingluvicola*, the crop Spirurid of poultry.

The development of the Cestode of fowls, *Hymenolepis carioca*, was observed in other beetles in addition to *Aphodius granarius*, L.; in an experiment in which *A. granarius* was used to effect transmission, *H. carioca* was transferred to the bobwhite quail. *Raillietina cesticillus*, another Cestode that infests fowls, was found capable of development in certain beetles; work by other investigators had previously indicated the house-fly [*Musca domestica*, L.] as an intermediate host of this Cestode, but the evidence was incomplete.

Encysted larval Nematodes that occurred in large numbers in the loggerhead shrike [*Lanius ludovicianus*] and other wild birds in southern Georgia and northern Florida proved to be *Physocephalus sexalatus*, a stomach worm of the pig. Two Coprids, *Phanaeus carnifex* and *Canthon laevis*, Drury, which are eaten in large numbers by the shrikes, were found to serve as intermediate hosts. A small piece of the intestine of a shrike heavily infested with larvae was fed to a pig,

and some 800 Nematodes developed in the animal; when encysted Nematodes from shrikes were fed to other birds, mammals or reptiles, however, they re-encysted as third stage larvae, but did not undergo further development.

Investigations in Louisiana showed that anaplasmosis of cattle in that State is identical with the disease occurring in Africa and South America, and it was found experimentally that the disease as it occurs in pure infections in areas free from *Boophilus annulatus* [*cf.* xvii, 148] is identical with the form occurring in conjunction with piroplasmosis in areas in Texas infested with this tick. Larvae of *B. annulatus* from eggs laid by females that had engorged on cases of pure anaplasmosis conveyed the disease to a healthy animal in one out of four cases, this being the first occasion on which experimental transmission by this means had been obtained in the United States. A similar experiment with *Amblyomma americanum*, L., gave negative results.

Various methods of controlling warble-flies of cattle were tested on a large scale in an area in Illinois where the species concerned was *Hypoderma lineatum*, Vill., and in an area in Colorado where both *H. lineatum* and *H. bovis*, DeG., were present. For the extraction of the larvae by hand, small alligator forceps proved most satisfactory; to prevent the transference of bacterial infection from the lesions of one animal to those of another, a fresh pair of forceps was taken for each animal, and each pair was sterilised after use. A vacuum pump attached to a petrol engine, and fitted with a special nozzle, had the advantage of removing the pus with the larvae, and so reducing the tendency for abscesses to form, but it only extracted 80 per cent. of the larvae. In Colorado, the inspection of cattle and extraction of larvae was carried out from 28th December to 15th March. When the work began, there were 3,630 head of cattle in the area; these had all been dealt with by 30th January, and 106,574 larvae had been removed, in 2,776 man-hours. A second examination from 25th January to 15th February, and a third from 23rd February to 15th March, resulted in the extraction of 14,728 larvae from 3,721 head of cattle in 661 man-hours, and 981 larvae from 3,497 head in 271 man-hours, respectively. It appears that light-coloured cattle are more heavily infested by *Hypoderma* than dark.

WALKER (J.). **Heartwater** (*R. ruminantium*).—*Bull. Dept. Agric. Kenya*, no. 25, 10 pp., 3 figs. Nairobi, 1929.

Heartwater, which is caused by *Rickettsia ruminantium*, is fairly prevalent in Kenya in areas where the vectors, *Amblyomma variegatum*, F., and *A. hebraeum*, Koch, breed freely, the most severe losses being among animals that have been reared on non-infested pasture, in which the mortality sometimes amounts to 20 per cent. in cattle and 50 to 80 per cent. in sheep and goats. A good deal of the information about the ticks is taken from a paper already noticed [*R.A.E.*, B, ix, 83]. Both species transmit the disease in the nymphal and adult stages after feeding on an infected animal in the previous stage. Nymphs can feed on a non-susceptible animal without losing the infection acquired in the larval stage and can transmit the disease in the adult stage. Infection does not pass through the egg. The eradication of the ticks is the best method of combating the disease, and dipping is the best measure for this purpose. The ticks, which attack a variety of animals

and birds, require three hosts, the larvae and nymphs each remaining on the host for 5–7 days, and the adults for 10–14. In order to destroy the immature stages before they drop from their hosts, dipping should theoretically be carried out every five days. As the adult ticks are very resistant to arsenic, a ten-days' strength is the best dip to use against them, but this is rather dangerous for small stock and woolled sheep ; the usual practice is weekly dipping of all stock in a seven-days' strength. Suggestions are made for varying this practice to meet local conditions, kinds of stock to be treated, etc. For hand-dressing of the ears, brush of tail, etc., of high-grade woolled sheep or other animals for which dipping is not applicable, an emulsion composed of 1 lb. hard soap in 1 gal. soft water and 4 gals. paraffin, diluted with about 1½ parts water, is recommended. Auxiliary measures are starving the ticks by keeping pastures free from all hosts for 12 months or more, and burning infested grass ; the latter measure can be only partly successful, as the ticks during moulting and egg-laying lie secure on the ground. When the disease has broken out and a dip is not available, the stock should be moved through quarantine camps, as previously described [*loc. cit.*].

[Olenev (N. O.).] **Оленев (H. O.). Sur la classification et la distribution géographique des Ixodides. iv.** [*In Russian.*]—*C.R. Acad. Sci. U.R.S.S.*, 1929, no. 21, pp. 489–494, 6 figs., 5 refs. Leningrad, 1929.

Notes are given on the distribution in the Russian Union of several ticks of the genus *Ixodes* and two new ones are described. From a comparison of the descriptions and figures the author concludes that *I. theodori*, Warburton, described from Palestine [*R.A.E.*, B, xvi, 96], is a synonym of *I. redikorzevi*, Olenev [xvi, 18]. The distribution of *I. ricinus*, L., is closely connected with climate, and abundant humidity is essential for its breeding. In the north-west of European Russia it occurred in low-lying damp pastures or in growths of alder trees. Its hosts include cattle, horses, sheep, dogs, cats, and a number of wild animals and birds ; it also occasionally attacks man.

Yakimoff (W. L.), Belawine (W. S.), Rastegaïeff (E. F.) & Schlüpikoff (A. L.). **Zur Biologie der Zecke *Boophilus annulatus calcaratus*, Bir.** [The Biology of the Tick, *B. annulatus calcaratus*.]—*Z. Infekt Kr.*, xxxvi, no. 3, pp. 137–152, 16 refs. Berlin, 10th September 1929.

In the North Caucasus *Boophilus annulatus calcaratus*, Bir., transmits a number of blood parasites of cattle, *viz.*, *Françaiella colchica*, the agent of red-water [*R.A.E.*, B, xvii, 79], *Piroplasma bigeminum*, *Spirochaeta theileri* and *Anaplasma rossicum*. Its biology is comparatively unknown. It appears on cattle at the end of March and early in April, and disappears in September and October. The complete life-cycle requires 85–89 days, so that two generations can occur in the warm season, and the appearance of the larvae coincides with the outbreaks of piroplasmosis in April–May and in July. Under favourable conditions the larvae can resist starvation for over 7 months. They may be killed by cold, marked variation in temperature, or exposure to direct sunshine, and are subject to a fungous infection if humidity is excessive.

In localities where the temperature varies from 20–25° C. [68–77° F.] by day to 10–15° C. [50–59° F.] by night the tick cannot maintain itself. The eggs develop readily in summer, but often fail to hatch in winter. Winter temperatures and direct sunshine may also prevent oviposition.

[Yakimov (V. L.) & Rastegaeva (E. F.).] Yakimoff (W. L.) & Rastegaïeff (E. F.). **Epizootie de spirochétose des poules à Piatigorsk (Nord du Caucase).**—*Bull. Soc. Path. exot.*, xxii, no. 9, pp. 764–765. Paris, 1929.

An outbreak of spirochaetosis in fowls was observed during the summer of 1929 at Piatigorsk, North Caucasus. The very hot weather was favourable for the development of the vector, *Argas persicus*, Oken. *Dermanyssus gallinae*, DeG., also occurred, but did not transmit the disease experimentally to young chickens.

Remlinger (P.) & Bailly (J.). **La fièvre récurrente au Maroc. Le spirochète marocain.**—*Bull. Soc. Path. exot.*, xxii, no. 9, pp. 818–862, refs. Paris, 1929.

The history of the Moroccan form of Spanish relapsing fever, of which the natural vector is *Ornithodorus erraticus*, Lucas (*marocanus*, Vélu), is reviewed, and the differences between this form of the disease, which is caused by *Spirochaeta hispanica* var. *marocana*, and those caused by *S. duttoni* and *S. recurrentis* (*obermeieri*) are discussed. Experiments on the susceptibility of various animals to the infection are described, and the possibility of hereditary transmission in guinea-pigs is demonstrated. Notes are given on the various methods of inoculation and on the position of the virus in the vertebrate host. The question of substituting treatment with this spirochaete for malaria therapy in cases of paralysis is discussed.

Spanish relapsing fever is rare in the region of Tangiers, and no ticks were found either on pig farms or in the burrows of rabbits, small rodents or porcupines examined [*cf. R.A.E.*, B, xvi, 159, 219; xvii. 122].

Hatt (P.). **Observations sur l'évolution des spirochètes des fièvres récurrentes chez les ornithodores.**—*Arch. Inst. Pasteur Tunis*, xviii, no. 3–4, pp. 258–264, 5 figs. Tunis, November 1929.

Observations on the evolution of relapsing fever spirochaetes in *Ornithodorus* spp. were made by the examination of sections of artificially infected nymphs, the technique being similar to that employed by Nicolle and Lebailly [*R.A.E.*, B, viii, 97]. In the case of *O. moubata*, Murr., infected with *Spirochaeta duttoni*, the spirochaetes, which had been plainly visible in the cells of the intestinal epithelium an hour after ingestion, had completely vanished at the end of 3 days. Rods and granules, resulting apparently from the fragmentation of the spirochaetes, were observed in the intestinal epithelium. In *O. savignyi*, Aud., infected with *S. hispanica*, the digestive tract still contained normal forms at the end of 5 days, rods and granules were observed in the epithelium on the 9th day, and fragments of the spiro-

chaetes were still visible in the digestive tract at the end of 20 days. The blood of the ticks, examined at frequent intervals for 20 days, never showed the presence of any spirochaetes, but an examination on the 26th day gave a strongly positive result. In the case of *O. savignyi* infected with *S. duttoni*, the tick was completely overrun by the spirochaetes on the 19th day, the parasites occurring in the blood, epithelia and tissues, and digestive tract. The appearance of a large number of spirochaetes in the blood was also observed in *O. savignyi* infected with *S. normandi*. In one isolated case in which the blood of an adult female of *O. savignyi* was found to contain spirochaetes 6 days after ingestion, the spirochaetes may have passed directly through the walls of the digestive tract. All the other experiments, however, with ticks infected in the nymphal stage indicate that the walls of the digestive tract constitute an effective barrier against the direct passage of the spirochaetes, and suggest that a morphological evolution takes place, preparing for the infection of the blood with new spirochaetes.

A section taken from the ovary of an adult of *O. moubata* infected for some time with *S. hispanica* showed a single egg full of spirochaetes and containing also rods and granules. None of the remaining eggs was infected with the exception of the adjacent one, which showed a few spirochaetes along its membrane. The egg containing spirochaetes and granules might be a centre for the multiplication and evolution of the parasites.

Papers noticed by Title only.

Lamborn (W. A.). **The remarkable Adaptation by which a Dipterous Pupa (Tabanidae) is preserved from the Danger of Fissures in drying Mud.** [*Tabanus biguttatus*, Wied.]—*Proc. Roy. Soc.*, Ser. B., cvi, no. B.741, pp. 83–87, 1 pl., 1 fig. London, 14th January 1930.

Enderlein (G.). **Ueber einige neotropische Simuliiden des Genus *Friesia*. (Dipt.)** [On two Neotropical Species, one new, of *Simulium* (*Friesia*).]—*Deuts. ent. Z.*, 1929, no. 4, pp. 327–328, 2 figs. Berlin, 30th November 1929.

Nicolle (C.), Anderson (C.) & Colas-Belcour (J.). **Sensibilité du porc-épic au spirochète des terriers des petits rongeurs sauvages du Maroc *Sp. hispanicum* var. *marocanum*.**—*Arch. Inst. Pasteur Tunis*, xviii, no. 3–4, pp. 343–346, 2 refs. Tunis, November 1929. [*Cf. R.A.E.*, B, xvii, 226.]

Weiss (A.). **Sur les puces ou aphaniptères (siphonaptères) de la Tunisie et leurs rapports avec les hôtes qu'elles parasitent.**—*Arch. Inst. Pasteur Tunis*, xviii, no. 3–4, pp. 379–382. Tunis, November 1929.

Remlinger (P.), Cabanié (—) & Bailly (—). **Un cas de fièvre récurrente à spirochètes virulents pour le cobaye dans la zone espagnole du Maroc.**—*Arch. Inst. Pasteur Tunis*, xviii, no. 3–4, pp. 383–386, 4 refs. Tunis, November 1929.

Nicolle (C.) & Anderson (C.). **Indifférence des spirochètes récurrents pour leurs hôtes du genre Ornithodore.**—*Acta med. scand.*, lxx, no. 5–6, pp. 392–395. Stockholm, 1929. [*Cf. R.A.E.*, B, xvii, 62.]

COLAS-BELCOUR (J.). **Présence d'***Ornithodorus coniceps* **en Tunisie.**—*Arch. Inst. Pasteur Tunis*, xviii, no. 3–4, pp. 265–267, 8 refs. Tunis, November 1929.

Ornithodorus coniceps, Can., is recorded on *Vespertilio kuhli* in Tunis, where an engorged larva was discovered in a loft, fixed on the wing membrane of one of these bats. The larva was removed on 29th June to the laboratory, where it reached the fifth moult on 11th December, moulting twice without being fed and feeding three times on a pigeon. This tick is closely allied to *O. talaje*, Guér., but on account of morphological differences coupled with its geographical distribution, it is considered a distinct species by Brumpt and Larrousse. Larrousse believes the ticks recorded as *O. talaje* from Fez [*R.A.E.*, B, ix, 78] to be *O. coniceps*. Whereas *O. talaje*, which often frequents dwellings, feeds on various animal hosts [*cf.* xv, 158], *O. coniceps* is exclusively connected with pigeons; the loft in which it was discovered was frequented by these birds. Although it has never been recorded as transmitting spirochaetes to man, it can attack man in the absence of its customary hosts.

DELANOË (P.). **Contribution à l'étude du spirochète de l'ornithodore des terriers du Maroc** *Sp. marocanum*, **Ch. Nicolle et Ch. Anderson 1928.**—*Arch. Inst. Pasteur Tunis*, xviii, no. 3–4, pp. 272–342, 6 graphs, 15 refs. Tunis, November 1929.

In this second memoir on the spirochaetes isolated from *Ornithodorus erraticus*, Lucas (*marocanus*, Vélu) from the burrows of porcupines in the Doukkala region of Morocco [*R.A.E.*, B, xviii, 17], a detailed account is given of studies on the susceptibility of various animals to one of the strains, and to *Spirochaeta hispanica* var. *marocana* of Mansouria, and of cross-immunity studies with these two spirochaetes. Details are also given of experiments in which human infections of a non-recurrent type were obtained by inoculating the Mansouria strain and three strains from *O. erraticus* from porcupine burrows. The principal conclusions reached by the author as the result of these studies have already been noticed [xvii, 226]. He is convinced that *Spirochaeta marocana* is a distinct species that occurs in *O. erraticus* on wild animals and produces in a man a mild, non-recurrent fever of short duration that is found throughout Morocco. What animal or animals constitute the reservoir of infection remains to be determined. The natural vector of the strains of *S. hispanica* affecting man, discovered at Kenitra by Chaubet and at Bou Znika, near Rabat, by Hornus [xvii, 146, 168] also remains to be determined; it may be *O. erraticus*, but the author considers that proof of this is still needed. Finally the author replies to the criticisms of his first memoir by Nicolle and Anderson [xviii, 19].

NICOLLE (C.) & ANDERSON (C.). **Sur la notion d'espèce chez les spirochètes récurrents du Maroc et le rôle du porc-épic dans leur conservation et leur transmission naturelles.**—*Arch. Inst. Pasteur Tunis*, xviii, no. 3–4, pp. 347–351, 4 refs. Tunis, November 1929.

This is a criticism of the preceding article. The authors do not consider that there is sufficient justification for regarding any of the spirochaetes transmitted by *Ornithodorus erraticus*, Lucas (*marocanus*, Vélu) in Morocco as specifically distinct from *Spirochaeta hispanica* [*cf. R.A.E.*, B, xviii, 19].

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Hase (A.). **Ueber Aufgaben der medizinischen Entomologie.** [The Tasks of Medical Entomology.]—*Deutsche Forschung*, Heft 9, pp. 44–79. Berlin, 1929.

This is a detailed discussion of the reactions produced by the bites of different kinds of blood-sucking insects.

Edwards (F. W.). **A new *Anopheles* from the Central Sahara.**—*Arch. Inst. Pasteur Algérie*, vii, no. 1, pp. 82–87, 3 figs. Algiers, 1929.

Collections of mosquito larvae and reared adults from Southern Algeria included, in addition to *Anopheles hispaniola*, Theo., and various Culicines, a new Anopheline of the sub-genus *Myzomyia*, the adult and larva of which are described under the name of *Anopheles broussesi*. This new species, which generally resembles both *A. hispaniola* and *A. multicolor*, Camb., was found breeding together with *Culex deserticola*, Kirkp., in collections of pure, perfectly fresh water, usually in small basins excavated in the bed of a stream that irrigates a palm grove. Some green algae that were present in the water evidently formed the food of the larvae, as remains of filamentous algae were found in the gut. The breeding of *A. broussesi* continues throughout the winter.

Mieldazis (J. J.). **Preferential breeding Conditions of *Anopheles* in the Philippine Islands.**—*Philipp. J. Sci.*, xli, no. 1, pp. 59–63, 6 pls. Manila, January 1930.

Anopheles minimus, Theo., is commonest where it is associated with bamboo, its favourite breeding-place being among the roots of a clump of bamboo along a heavily shaded stream; larvae have also been found attached to stones in shady streams. They only occur in running water in the Philippines, chiefly at the intersection of the coastal plain with the foot of the mountain range. They have not been found where the streams are affected by the tide, or in masses of algae exposed to sunlight close to bamboo shade. *A. maculatus*, Theo., prefers mats of grass roots or collections of algae along the edges of clear mountain streams, exposed to sunlight, and occurs up to 3,500 ft. above sea level. It has also been found in an isolated pool in a stream bed, associated with *A. barbirostris*, Wulp, and *A. vagus*, Dön., and sometimes occurs in partly shaded streams.

A. philippinensis, Ludl., is closely associated with *Pistia stratiotes*, in pools, rivers and streams in the foothills of the mountains; it is also found in rice-fields into which collections of this plant have been carried by irrigation canals. *A. ludlowi*, Theo., and *A. subpictus*, Grassi, usually occur in association, among algae exposed to the sun along the edges of large rivers with sandy or gravelly beds, in the coastal plain, and they are also found in fish ponds and salt-evaporation beds. *A. subpictus* is more widely distributed than *A. ludlowi*, but it does not withstand such a high degree of salinity.

A. vagus is the most widely distributed Anopheline in the Philippines; its larvae are found in association with those of most other species except *A. ludlowi* and *A. subpictus*, and also in water that is too much contaminated for other Anophelines, such as that in buffalo wallows and stagnant pools. *A. barbirostris* usually occurs among *Chara* or

other algae or *Lemna* along the edges of streams, in irrigation canals or in rice-fields ; it is found in still and swiftly flowing water, in the deep parts of mountain streams and in the rivers of the coastal plain. *A. fuliginosus*, Giles, breeds in rain-water ponds, lakes of impounded water and streams. *A. kochi*, Dön., breeds principally in rain-water pools without surface vegetation and with clean mud banks, but it has also been found in rice-fields. A few larvae of *A. tessellatus*, Theo., were found in grass along the edges of irrigation canals, and it is believed to breed in seepage areas among cogon grass [*Imperata exaltata*]. Larvae of *A. umbrosus*, Theo., were found along the rib of a dead palm leaf floating on the surface of a shady stream in Mindanao ; this species has not been reported from any other part of the Philippines.

Ejercito (A.). **Summarized Report on Malaria Surveys and Control in Mindanao and Sulu.**—*J. Philipp. Is. Med. Ass.*, ix, no. 8, pp. 277–283. Manila, August 1929.

In a survey of Mindanao, Sulu and the adjacent islands, *Anopheles minimus*, Theo., which has previously been considered to be the vector of malaria in the Philippines [*R.A.E.*, B, xvii, 64], was found breeding in every locality in which malaria occurred, with two exceptions ; in one locality *A. minimus* is known to occur at certain seasons of the year, but in the other there are no suitable breeding-places for this Anopheline, and it is possible that all the malaria there is imported. Other Anophelines found breeding in streams were *A. barbirostris*, Wulp, *A. hyrcanus*, Pall., *A. ludlowi*, Theo., and *A. vagus*, Dön., in Mindanao and Sulu, and *A. maculatus*, Theo., *A. aitkeni*, James (two types of larva), *A. subpictus*, Grassi, *A. umbrosus*, Theo., and a species that is probably new, the larva and adult of which are briefly characterised [*cf.* xvii, 194], in Mindanao. Details are given of the organisation and application of control measures against *A. minimus* [xviii, 32].

Root (F. M.). **The Present Status of our Knowledge of the** *Nyssorhynchus* **Group of Anopheline Mosquitoes.**—*4th Int. Cong. Ent. Ithaca, N. Y. 1928*, ii (Trans.), pp. 316–321, 11 refs. Tring, England, 1929.

The taxonomy and distribution of Anophelines of the *Nyssorhynchus* group is discussed. The author's views on the synonymy of most of the species have already been indicated [*cf. R.A.E.*, B, xiv, 197 ; xvi, 240 ; xvii, 14, 85], but *Anopheles pictipennis*, Philippi (*bigoti*, Theo.) from Chile is regarded as a distinct species, and *A. oswaldoi*, Peryassú, is considered a synonym of *A. tarsimaculatus*, Goeldi [*cf.* xvii, 15].

A comparison of the distribution of this group with the distribution of malaria indicates that *A. albimanus*, Wied., and *A. albitarsis*, Arrib., are probably the most dangerous vectors of the disease, *A. tarsimaculatus*, although less important, being of some economic significance.

Baerg (W. J.). **Some Poisonous Arthropods of North and Central America.**—*4th Int. Cong. Ent. Ithaca, N. Y. 1928*, ii (Trans.), pp. 418–438, 86 refs. Tring, England, 1929.

An account is given of studies on various species of tarantulas, scorpions and centipedes and on *Latrodectus mactans*, F., from North

and Central America. Only one species of tarantula, *Sericopelma communis*, Cambr., has a poison that appreciably affects man, and its bite, although painful, does not appear to be dangerous. The poison of the scorpion, *Centruroides suffusus*, Pocock, is a neurotoxin that causes convulsions and paralysis of the respiratory system in rats and guineapigs, and death usually ensues in thirty minutes to an hour. The poison has a similar effect on man, and is reliably reported as frequently causing death in children. The bite of *Latrodectus mactans* produces in man severe muscular pain that lasts for several days and a mild degree of paralysis that disappears in a few hours. Although the poison is not likely to produce fatal results, it may under certain circumstances be regarded as dangerous.

BEQUAERT (J.). **The Insect Carrier of** *Onchocerca volvulus* **in Liberia.**—*4th Int. Cong. Ent. Ithaca, N. Y. 1928*, ii (Trans.), pp. 605–607, 8 refs. Tring, England, 1929.

In view of the restricted geographical distribution of *Onchocerca volvulus* and the fact that man is the only vertebrate host, it would seem probable that only one or a few species of the widely occurring genus *Simulium* are able to act as vectors. Several cases of infection with *O. volvulus* among natives in the interior of Liberia were observed by the Harvard African Expedition in 1926–27. Dissection of a number of flies revealed the larvae of *O. volvulus* in a species that appears to be identical with *S. damnosum*, Theo., the fly with which Blacklock's work was carried out in Sierra Leone [*R.A.E.*, B, xiv, 62, 167]. It also appears to be the most common Simuliid in Liberia.

HERMS (W. B.). **Anopheline Mosquito Investigations in California.**—*4th Int. Cong. Ent. Ithaca, N. Y. 1928*, ii (Trans.), pp. 708–721, 6 figs., 19 refs. Tring, England, 1929.

The history of malaria and its control in California is discussed [*R.A.E.*, B, vii, 163; x, 64, 65; xiv, 85; xvii, 67, etc.]. The results of recent experiments, which are briefly described, indicate that yeast can be used as the sole food for larvae of *Anopheles maculipennis*, Mg. (although an emergence of only 10 per cent. was obtained with 3 gm. yeast to a litre of distilled water), but a more rapid development and greater size is obtained by using certain protozoa in pure culture, particularly a species of *Bodo*. In the author's opinion the pH of a solution does not play an important part in the development of the larvae. Brief notes are given on the proportions of the sexes in mosquitos collected during the autumn of 1927 and on their oviposition habits in the laboratory.

MATHESON (R.) & HINMAN (E. H.). **A Seasonal Study of the Plancton of a Spring-fed Chara Pool versus that of a Temporary to Semi-permanent Woodland Pool in Relation to Mosquito Breeding.**—*Amer. J. Hyg.*, xi. no. 1, pp. 174–188, 1 chart, 13 refs. Baltimore, Md., January 1930.

A comparative study was made of the plankton in a typical pool containing *Chara* where no mosquito breeding was observed and in a typical woodland pool in which larvae were abundant, in order to determine whether the failure of breeding in the *Chara* pool was due to

lack of food essential to mosquito development [*cf. R.A.E.*, B, xvii, 214]. Samples of phyto- and zoo-plankton were taken at weekly intervals throughout the spring and summer and every two weeks during the late autumn and winter, over a period of 12 months in the case of the *Chara* pool and for four months (until the water dried up) in the case of the woodland pool. It was found that, with the exception of the Crustacea, both the number of species of phyto- and zoo-plankton and their density were always greater in the pool containing *Chara*. At all times the plant plankton was scarce in the woodland pool. This might have been accounted for early in the season by the excessive abundance of mosquito larvae, but it was as rare in June, when no mosquito larvae were present and the density of the Crustacea was greatly reduced. It would therefore appear that the abundance of plankton has no relation to mosquito breeding, and the authors agree with Rudolfs and Lackey [*R.A.E.*, B, xvii, 86] that bacteria are not in themselves essential for it.

The only other foods in the water were substances in solution and decaying wastes, and the senior author's view that these substances form much of the food of mosquito larvae is supported by a recent experiment in which larvae of *Aëdes argenteus*, Poir. (*aegypti*, L.) were reared to maturity in about the normal time required for development (11 days) in water from which all bacteria and other animal and plant life had been removed by filtration. It is suggested that the explanation of the results obtained by Rudolfs and Lackey is that the decomposition of vegetable matter in the breeding pool furnished an abundance of solutes and organic wastes suitable for digestion by the larvae as well as food for the plankton. From the fact that the *Chara* pool contains an abundance of plankton, it is evident that water conditions supporting a dense growth of plankton are not necessarily suitable for mosquito breeding. In this pool an excessive supply of oxygen is always present, and it is possible that the excessive amount of oxygen ingested by the larvae has a deleterious effect on the digestive processes, or that the oxygen in some way affects the food-supply so as to render it unavailable. The first theory is supported by an experiment in which it was found that larvae die in 2–4 days when subjected to a stream of minute oxygen bubbles, the period preceding the death of the larvae corresponding almost exactly to that in experiments with *Chara*. The question of varying pH values in natural waters appears to have little significance in the study of mosquito development.

BEATTIE (M. V. F.). **Physico-chemical Factors in Relation to Mosquito Prevalence in Ponds.**—*J. Ecology*, xviii, no. 1, pp. 67–89, 1 pl., 5 figs., 8 refs. London, February 1930.

HOWLAND (L. J.). **Bionomical Investigation of English Mosquito Larvae, with special Reference to their Algal Food.**—*T.c.*, pp. 81–125, 10 figs., 26 refs.

Both these papers relate to investigations carried out on the same ponds in Buckinghamshire.

The following is taken from the authors' summaries: The chemical factors considered to have some bearing upon the determination of the breeding of the mosquitos, which included *Anopheles maculipennis*, Mg., *A. bifurcatus*, L., and various Culicines, were pH, hydrogen sulphide, organic nitrogen and dissolved oxygen. No definite correlation

was found, but further investigation should be made. There was no correlation between larval incidence and ammonia nitrogen. Chlorides and solids in the small amounts present were considered to be of no biological significance. Albuminoid nitrogen could be neglected, since the total organic nitrogen was estimated. More attention should have been given to nitrates, nitrites and phosphates.

The author of the second paper examined over 1,000 larvae of various species, including both the Anophelines, and noted the frequencies of the algae in the gut. The larvae were also measured. The temperature, pH values and CO_2 content of the ponds were noted. No definite correlation was found between the number of larvae and the pH and CO_2 content of the water, nor was there any definite correlation between the size of the larvae and that of the algae eaten. There appeared to be no decided preference for any one kind of food by the larvae in any one pond, but the species of larvae found in a pond seemed to be related to the algal flora. Apparent correlations between the spring and summer phases of algae and the appearance of larvae were noted. The Culicines devoured more algae than did the Anophelines, which does not agree with Senior-White's observations in India.

[Biryukov (W. I.).] **Бирюков (В. И.). Ueber die Frage des Zusammenhangs zwischen der Wasserstoffionenkonzentration und der Verteilung von Mückenlarven in den Gewässern der Umgegend von Charkov.** [The Question of the Connection between the Hydrogen-ion Concentration and the Distribution of Mosquito Larvae in the Waters in the Neighbourhood of Kharkov. (*In Russian.*)]—*Russ. hydrobiol. Z.*, vii, no. 10–12, pp. 251–256, 10 refs. Saratov, October–December 1928. (With a Summary in German.)

In 60 pools, etc., in the Kharkov district, the author found larvae of *Anopheles*, *Culex* and *Aëdes* only at a pH of 7·2, 7·4 and 7·6, those of *Anopheles maculipennis*, Mg., being particularly numerous at 7·4. The larvae of this species required clean water for successful development. *Culex* larvae could live also in somewhat contaminated water, while those of *Aëdes* developed in very much dirtier water. No larvae of *A. maculipennis* were observed in heavily shaded waters, or those that did not contain plants.

[Mess (A.).] **Mecc (A.). Contributions à la faune de moucherons sanguisuges (Diptera, Culicidae) de la région des Eaux Minérales du Caucase.** [*In Russian.*]—*Annu. Mus. zool. Acad. Sci. U.R.S.S.*, xxx, pt. 4, pp. 525–530, 1 ref. Leningrad, 1930.

A list is given of 24 species of mosquitos observed in 1926 in summer resorts in the northern Caucasus, with notes on their local distribution and breeding-places. They include *Anopheles maculipennis*, Mg., *A. bifurcatus*, L., and *A. plumbeus*, Steph. Besides the usual breeding-places, single larvae of *A. maculipennis* were found in hollows in trees, which differed from those harbouring the larvae of *A. plumbeus* by the light-yellow colour of the water they contained, and had a layer of earth at the bottom.

Sepulcri (P.) & Scrinzi (E.). **Contributo allo studio del problema dell' anofelismo nel Veneto. (Valli da pesca e caccia, bonifiche e anofelismo.)** [A Contribution to the Study of the Problem of the Occurrence of Anophelines in Venetia. Fishing and Shooting Areas, Reclamation Work and Anophelines.]—*Riv. Malariol.*, viii, no. 6, pp. 637–668, 14 figs. Rome, 1929. (With Summaries in Italian, p. 743, French, p. 745, English, p. 747, German, p. 749.)

This is a detailed report of a survey, in the coastal zone of the lagoon of Venice, of the reclaimed lands and of the " valli lagunari " or fenced fishing areas in the lagoon with their peripheral marshes. It was found that Anophelines were rare in the " valli," whereas they were common in the reclamation areas. Their occurrence in the former was due to fresh water drained from the latter, which, added to the natural supply from rivers, reduced the salt content of the sea-water to a degree permitting mosquito breeding. In the former areas Anophelines can be eliminated or reduced by covering channels and by changing the chemico-physical properties of the water, but in the reclamation areas there would seem to be no possibility of control.

Brighenti (D.). **La distribuzione geografica degli anofelini in Italia.** [The Geographical Distribution of Anophelines in Italy.]—*Riv. Malariol.*, viii, no. 6, pp. 694–701, 27 refs. Rome, 1929. (With Summaries in Italian, p. 744, French, p. 746, English, p. 748, German, p. 750.)

Of the eight Anophelines recorded in Italy, *Anopheles maculipennis*, Mg., *A. bifurcatus*, L., and *A. algeriensis*, Theo., are more or less uniformly distributed, *A. plumbeus*, Steph., occurs only in northern Italy, and *A. superpictus*, Grassi, and *A. italicus*, Raffaele, only in the South. *A. sacharovi*, Favr, and *A. hyrcanus* var. *pseudopictus*, Grassi, are found in coastal areas and in rice-fields. The local distribution of the various species is indicated. The Anopheline fauna of Italy resembles that of the Eastern Mediterranean rather than that of the remainder of Continental Europe, which is poorer in species.

[Guelmino (G.).] **Гуелмино (Ђ.). On larvicide Powders.** [*In Serbian.*]—*Glasnik Tzentr. Khig. Zavoda*, iii (v), no. 1–6, pp. 42–46. Belgrade, 1928. (With a Summary in French.) [Recd. 1930.]

The importance in an anti-malaria campaign of measures against mosquito larvae is emphasised, and the properties of Paris green, as one of the best means of control, are discussed. In southern Serbia dusting should begin at the end of April and be repeated every 9–10 days. The Paris green, mixed with a carrier (road dust, ashes or sand) at the rate of 1 : 100, should be applied at the rate of 1 lb. of poison to the acre of the area of water for a distance of about 2 miles beyond the area to be protected, this being the maximum distance over which the Anophelines can fly. The effect of the dusting should be verified by periodical counts of the mosquitos taken in control places (usually cattle sheds) and of the larvae occurring in a given unit of water surface. The advantages of Paris green as compared with oiling are pointed out, including economy of time and labour. Paris green does not prevent the mosquitos from ovipositing in the treated water, whereas they avoid oiled areas for this purpose and oviposit elsewhere,

thus forming new breeding foci. Moreover, it is not necessary to remove the weeds from the surface of the water, which is essential when applying oil. An account is given of the successful results of dusting carried out in the summer of 1927 in two localities severely infested with *A. maculipennis*, Mg., and *A. superpictus*, Grassi. The density of larvae to a unit of water surface was reduced from 164–200 to 0–1, and the numbers of adults in control cattle sheds from hundreds to about thirty daily.

Simić (Č.). *Anopheles maculipennis*, **prenosioc je** *Dirofilaria immitis* **u J. Srbiji.** [*A. maculipennis* is a Vector of *Filaria immitis* in southern Serbia.]—*Glasnik Tzentr. Khig. Zavoda*, iii (vi), no. 4–6, pp. 37–39. Belgrade, 1928. (With a Summary in French.) [Recd. 1930.]

The dissection of numerous individuals of *A. maculipennis*, Mg., *A. superpictus*, Grassi, and *Culex pipiens*, L., indicated that in southern Serbia the first-named only is the vector of *Filaria* (*Dirofilaria*) *immitis*, which infests the heart and lungs of dogs, often causing death. In the course of 24 hours after the mosquito has engorged on an infected dog, the embryos pass from its stomach into the Malpighian tubes, where they develop within 10–12 days at the expense of the cells of the tubes, which become very thin. They then pierce the tubes and pass into the labium of the mosquito, where they are ready for transmission to dogs. Of 612 individuals of *A. maculipennis* taken between June and October in stables in the outskirts of Skoplje, 13 contained *F. immitis*. As the percentage of the infected mosquitos steadily decreased towards the end of the summer, and as in the majority of cases the filaria had not reached the labium, the author thinks it probable that most of the infected mosquitos are killed by the filaria before it reaches maturity. An attempt to infect a puppy by introducing filariae from mosquitos under its skin was not successful.

Nieschulz (O.). **Bemerkung über Mückenzucht.** [A Note on Mosquito Breeding.]—*Zbl. Bakt.* (1, Orig.), cxv, no. 5–6, pp. 399–400, 1 fig. Jena, 3rd February 1930.

For feeding *Aëdes argenteus*, Poir. (*Stegomyia fasciata*, F.) the wooden roof of the gauze breeding-cage has an oval aperture about 6 by 3 inches. A screen of wire gauze is fastened under this aperture so as to form a trough in which a half-grown guineapig can be placed, the animal being secured by a cover of wire gauze. A band passing over the back of the guineapig can be tightened so as to press its abdomen against the gauze beneath it. The mosquitos feed through the latter.

Ekblom (T.). **Some Observations on** *Stegomyia fasciata* **during a Visit to Greece in the Autumn of 1928.**—*Acta med. scand.*, lxx, no. 5–6, pp. 505–518, 6 figs., 10 refs. Stockholm, 1929.

An account is given of the biology of *Aëdes argenteus*, Poir. (*Stegomyia fasciata*, F.) in Greece, the information being mainly taken from the literature, but supplemented by personal observations. The author states that the larvae occur in marshes, in tanks in the parks, and in places where clothes are washed in the open, besides wells and earthenware vessels in the courtyards of houses. The relationship of *A.*

argenteus to dengue and yellow fever is discussed, and the distribution of the mosquito and of the two diseases throughout the world is shown on a map. It is pointed out that, broadly speaking, the areas in which dengue and yellow fever occur do not coincide.

The author's observations in Greece supported the view that dengue is contracted only where *A. argenteus* is found. In a town about 3,000 ft. above sea level, where no individuals of *A. argenteus* were discovered, the only cases of dengue were imported, whereas in another town about 2,000 ft. above sea level there was an epidemic of dengue, and *A. argenteus* occurred in considerable numbers.

SEYDEL (C.). **Rapport entomologique pour la Province du Katanga (Année 1928).**—*Bull. agric. Congo belge*, xx, no. 2, pp. 228–237. Brussells, June 1929.

A list is given of 48 species of mosquitos collected in the Katanga region, including 14 species of *Anopheles*. The local distribution of *Glossina morsitans*, Westw., *G. palpalis*, R.-D., *G. brevipalpis*, Newst., *G. fusca*, Wlk., and *G. pallidipes*, Aust., was found to agree with that recorded by Schwetz [*R.A.E.*, B, xvi, 36, etc.].

Tsetse Fly Regulations.—*Rhodesia Agric. J.*, xxvii, no. 1, pp. 68–69. Salisbury, January 1930.

This regulation, under the Tsetse Fly Act [*R.A.E.*, B, xvii, 162], which came into force on 13th December 1929, prohibits the movement of cattle or equines into areas infested by the tsetse-fly [*Glossina morsitans*, Westw.], and provides for the treatment of vehicles and persons leaving two infested areas to prevent carriage of the fly by them.

SIMIĆ (Č.). **Prilog poznavanju južno-srbijanskih vrsta *Phlebotomus*-a.** [Contribution to the Study of the Species of *Phlebotomus* in South Serbia.]—*Glasnik Tzentr. Khig. Zavoda*, iii (vi), no. 1–3, pp. 34–52, 7 figs. Belgrade, 1928. (With a Summary in French.) [Recd. 1930.]

A general account is given of the morphology and bionomics of sandflies of the genus *Phlebotomus*, and the anatomy of the six species occurring in Europe is discussed, with keys to both sexes. The species occurring in southern Serbia are *P. papatasii*, Scop., *P. major* var. *perniciosus*, Newst., and *P. minutus*, Rond. Only a single individual of *P. minutus* was taken by the author, who explains its rarity by the fact that it prefers to attack cold-blooded animals and very seldom occurs in places inhabited by man. *P. papatasii* is the commonest species and, together with *P. major* var. *perniciosus*, is abundant from May till the middle of September, having two generations a year. It only attacks man and only feeds indoors, usually during the night, but on rare occasions by day in dark quarters, whereas *P. major* var. *perniciosus* is abundant and bites outdoors only. The author took numerous males and females of the latter in the evenings on the verandah of his house, but not a single individual was taken indoors, although the windows were open. It is not known whether this species

attacks animals. Investigations should be made on the part possibly played by it in the transmission of sandfly fever, which is very common in the region, and on the places frequented by it during the day, as it approaches houses only in the evening.

Although the males of *P. papatasii* and *P. major* var. *perniciosus* do not bite, they are as numerous as the females and always accompany them on their search for food.

[Martzinovskiĭ (E. I.) & Shchurenkova (A. M.).] **Марциновский (Е. И.) и Щуренкова (А. М.). Sur le** *Phlebotomus caucasicus* **Marz.** [*In French.*]—*Russ. J. Trop. Med.*, vii, no. 10, pp. 671–674, 4 figs., 4 refs. Moscow, 1929. (With a Summary in Russian.)

The authors state that Popov in redescribing the male of what he thought to be *Phlebotomus caucasicus*, Marz. [*R.A.E.*, B, xiii, 167], actually described and illustrated *P. sergenti*, Parrot, which differs from it mainly in genital characters. As result of this error, *P. caucasicus* was subsequently regarded as a synonym of *P. sergenti* [xvii, 30, etc.]. The true *P. caucasicus* [vi, 79] is the species subsequently described by Popov as *P. li* [xiv, 134].

[Vlasov (Ya. P.).] **Власов (Я. П.) Sur la biologie de** *Phlebotomus sergenti* **Parrot.** [*In Russian.*]—*Russ. J. Trop. Med.*, vii, no. 10, pp. 688–692, 1 fig. Moscow, 1929.

Numerous adults of *Phlebotomus sergenti*, Parrot, were found in a large cave in Turkmenistan inhabited by thousands of bats. A detailed description of the cave is given. As the nearest human dwellings were situated over a mile away, the author concludes that the sandflies probably fed on the bats, especially as numerous individuals were observed on blood-stained bags containing captured bats. No larvae or pupae were found in the cave, but they probably breed in the excreta of the bats, which covers the bottom of the cave with a thick layer, kept moist by the proximity of a lake and the drops of water falling from the vaults.

Notes are given on other insects that occurred in the cave, including *Cimex lectularius*, L., found on the excreta of the bats and in the lake, into which the bugs probably fell from the vaults harbouring the bats. It is suggested that *C. lectularius* originally inhabited the nests of bats, and became a parasite of man when the latter dwelt in caves.

[Shchurenkova (A. I.), Demina (N. A.) & Pavlova (P. I.).] **Щуренкова (А. И.), Демина (Н. А.) и Павлова (П. И.). A simple and rapid Method of the Identification of the Females of** *Phlebotomus*. [*In Russian.*]—*Russ. J. Trop. Med.*, vii, no. 10, pp. 675–688, 4 pls., 7 refs. Moscow, 1929. (With a Summary in English.)

Since only the females of *Phlebotomus* bite man and transmit diseases, their identification is of more importance than that of the males. The literature on the subject is briefly reviewed [*R.A.E.*, B, xiv, 96; xvi, 32; xvii, 30], and an account is given of a simple method of identifying the females by the spermathecae, which are rendered visible by treating the terminal segments with pure lactic acid, the details of

the process being modified according to whether the specimens are freshly killed, dry, or preserved in spirit or Canada balsam. The structure of the spermathecae of *P. papatasii*, Scop., *P. sergenti*, Parrot, *P. caucasicus*, Marz., *P. major*, Ann., *P. kandelakii* [see next paper], *P. chinensis*, Newst., and a species of the group of *P. minutus*, Rond., from Turkestan, is discussed. One of the advantages of the method is that it leaves unchanged the relative positions of the spermathecae and the external genitalia, while the simplicity of the technique makes it possible to deal with a large amount of material in a day.

Although the identification of the female sandflies on characters of the pharynx is quite possible, it is more difficult, as the structure of the pharynx is much more complicated, and in some species the characters of the spermathecae are distinct whereas those of the pharynx are similar. The structure of the latter and of the posterior part of the buccal cavity is of value, however, for the identification of species of the *minutus* group, since these have spermathecae with a smooth outline that differ in some cases but slightly. The treatment of the pharynx with lactic acid is described, and the characters differentiating *P. papatasii*, *P. sergenti*, *P. major*, *P. kandelakii*, *P. chinensis* and the species from Turkestan in this respect are briefly discussed.

[Shchurenkova (A. I.).] **Щуренкова (А. И.). A new Species of *Phlebotomus* in U.S.S.R.** — *Phlebotomus kandelakii* **n. sp.** [*In Russian.*]—*Russ. J. Trop. Med.*, vii, no. 10, pp. 692–698, 2 pls. Moscow, 1929. (With a Summary in English.)

A detailed description is given of the male external genitalia, the spermathecae of the females and the pharynx of both sexes of *Phlebotomus kandelakii*, sp. n., which was found in Tiflis in 1917, and a comparison is drawn with the genitalia in both sexes of *P. major*, Ann., *P. major* var. *perniciosus*, Newst., *P. chinensis*, Newst., and *P. argentipes*, Ann. & Brun.

The author emphasises the fact that the identification of sandflies by these characters is much more practical and precise than by the micrometric measurement of the different parts of the body.

[Yatzenko (F. I.).] **Яценко (Ф. І.). On the Question of the Distribution in the Crimea and the Ukraine of the Subgenus *Stegomyia* and the Genera *Culex* and *Phlebotomus* in Connection with the Possibility of the Introduction of Dengue into these Regions.** [*In Ukrainian.*]—*Sanitarno-Entomol. Byul.*, i, no. 2, pp. 3–5. Kharkov, 1929.

Notes are given on the distribution of insects that are possible vectors of dengue, in relation to the danger of its introduction into the Ukraine and Crimea. *Aëdes argenteus*, Poir., does not occur in these countries, but might be introduced into Crimean ports by ships from the Caucasus. *Culex fatigans*, Wied., has once been recorded in the Ukraine, but was probably confused with *C. pipiens*, L. The characters distinguishing the adults and larvae of these two mosquitos are indicated and the distribution in the Ukraine of other species of *Culex* is discussed.

The species of *Phlebotomus* recorded in the Russian literature as occurring in the Crimea are enumerated. *P. papatasii*, Scop., is particularly abundant in Sebastopol, infesting 98 per cent. of the inhabited houses, as many as 500 sandflies being sometimes taken in a single room. Sandfly fever occurs in all the localities where *P. papatasii* is present, its incidence being highest in Sebastopol and lowest in northern Crimea. The author only once found the larvae of *P. papatasii*; they occurred in a small pit containing water. The importance of investigations on the possibility of the transmission of dengue by *P. papatasii* is emphasised.

[Tishchenko (O. D.).] **Тищенко (О. Д.). On the Question of the Hibernation of the House-fly** (*Musca domestica*). [*In Ukrainian.*]—*Sanitarno-Entomol. Byul.*, i, no. 2, pp. 10–14. Kharkov, 1929.

Observations on *Musca domestica*, L., carried out in Kharkov during two winters (1927–29) indicated that the flies do not occur outdoors from about the end of November till the end of March. They enter various types of hibernation quarters provided that these are less than 90 yards from the breeding-place of the autumn generation. Most of the flies occur in warm inhabited quarters, in which they remain active throughout the winter and lay eggs, which hatch in spring, or earlier in breeding-places such as kitchen refuse where conditions are favourable. The life of the adult flies is considerably longer in winter than in the summer (2 weeks in the laboratory as compared with 2–3 days). Very few are found in cold places, such as cellars or cow-sheds, at a temperature of 7–10° C. [about 45–50° F.]; these flies remain in a state of inactivity and die before the winter is over. The hibernating flies are somewhat smaller in size than the summer broods, especially those that occur in cold places. The author is inclined to conclude that a diapause does not occur in the life-cycle of *M. domestica*, and that the vitality of the flies is related to temperature and food. Little, however, is known of the possibility of its hibernating in the egg, larval or pupal stages.

Other flies found by the author hibernating in cellars were *Muscina stabulans*, Fall., *Fannia* sp., *Calliphora erythrocephala*, Mg., and *Drosophila* sp., the two last-named having also been recorded by others from warm quarters.

Dinulescu (G.). **Facteurs déterminant l'éclosion des oeufs de** *Gastrophilus intestinalis.*—*Ann. Paras. hum. comp.*, viii, no. 1, pp. 57–60, 2 refs. Paris, 1st January 1930.

Observations made in Rumania showed that the eggs of *Gastrophilus intestinalis*, DeG., laid on a horse, hatch in 6–13 days under normal conditions, but remain unhatched if the animal cannot reach them with its mouth. Eggs that had remained unhatched for 18 days hatched rapidly as soon as the animal was allowed access to them. Rubbing with a finger or slightly warmed glass rod caused a few eggs to hatch, but the larvae failed to emerge completely in the absence of moisture. Placing eggs in water or normal salt solution caused 4–5 per cent. to

hatch at least three months after they had been laid. When eggs were put in warm water or saliva at 36–38° C. [96·8–100·4° F.], all the viable ones hatched in a few minutes, and the larvae emerged and remained alive in the warm liquid for several hours.

The author suggests that horses could be protected from infestation by rubbing the parts of their bodies on which eggs of *G. intestinalis* are laid with a brush or cloth moistened with warm water, every five days during the flight period of the bot-fly. This would cause premature hatching, and would remove the larvae.

DINULESCU (G.). **Le *Stomoxys calcitrans*, ses attaques sur les chevaux et le bétail en Roumanie.**—*Ann. Paras. hum. comp.*, viii, no. 1, pp. 71–74, 1 pl., 2 figs., 1 ref. Paris, 1st January 1930.

Stomoxys calcitrans, L., is a serious pest of cattle, and especially of horses and mules, in Rumania. Observations on its habits, and the injury caused by its bites, the nature of which is described in some detail, were made in the delta of the Danube, where it is particularly common, breeding in fish offal and other refuse around the villages. The flies are most troublesome in August, when they are on the wing throughout the warmer part of the day. They do not fly on windy days. They are very numerous in sheltered places, and the animals avoid these, and collect at the edge of open water, facing the wind, in order to escape from them.

NEWMAN (L. J.). **Report of Entomologist.**—*Ann. Rep. Dept. Agric. W. Aust. 1928–29*, pp. 32–33. Perth, W.A., 1929.

Further colonies of the blowfly parasite, *Alysia manducator*, Panz. [*R.A.E.*, B, xvi, 198; xvii, 92] have been received from New South Wales and New Zealand. The local Encyrtid parasite, *Stenoterys fulvoventralis*, Dodd, has been reared in large numbers and distributed. Blowfly traps have been installed at various points to determine the abundance, distribution and seasonal appearance of the different species of blowflies and to demonstrate the effectiveness of trapping.

A danger exists that *Lyperosia exigua*, de Meij. (buffalo fly), which is well-established in the North-west of Western Australia, and is spreading down the coast, may be transported over the natural dry buffer area by the shipment of cattle to the South-west. Preventive measures have hitherto been directed against the transmission of larvae and pupae in manure on cattle boats, the use of this manure being totally prohibited, but the discovery of flies on such boats has occasioned the installation of spraying outfits at both port of shipment and of discharge. Breeding tests have shown that *L. exigua* is able to withstand the winter in the South-west.

[BOĬKIV (B. V.).] **Бойкив (Б. В.). Data for the Study of the Fauna of Arthropod Parasites of *Citellus pygmaeus* in the Region of Mariupol.** [*In Ukrainian.*]—*Sanitarno-Entomol. Byul.*, i, no. 2, pp. 15–18, 6 refs. Kharkov, 1929.

This paper deals with the fleas taken on *Citellus pygmaeus* and in its nests in the steppes of the Mariupol district (S.E. Ukraine) in May, June and August 1926. The percentages of the fleas captured were: *Neopsylla setosa*, Wagn., 49, *Ctenophthalmus orientalis*, Wagn., 39,

Ceratophyllus tesquorum, Wagn., 2, *C. consimilis*, Wagn., 5, and unindentified species 5. The three first-named species occurred in much larger numbers in the nests than on the animals themselves. *C. tesquorum* and *N. setosa* readily bite man [*R.A.E.*, B, xiv, 66], but plague does not occur among the ground-squirrels in the Mariupol district; the reason for this requires investigation.

[Ioff (I. G.).] **Иофф (И. Г.). Materialien zum Studium der Ectoparasitenfauna im Süd-Osten der U.d.SSR. v. Flöhe der Springmäuse (Dipodidae). vi. Flöhe der Blindmäuse (Spaladicae). vii. Die Flöhe der Steppeniltisse.** [Materials for the Study of the Ectoparasite Fauna of the South-east of U.S.S.R. v. The Fleas of Jerboas (Dipodidae). vi. The Fleas of Blind Rats (Spalacidae). vii. The Fleas of the Steppe Weasels. (*In Russian.*)]—*Izv. Gosudarstv. Mikrobiol. Inst. Rostov-na-Donu*, pt. 8, 60 pp., 18 figs., 28 refs. Rostov-on-Don, August 1929. (With a Summary in German.)

The first of these papers is an extensive review of a previous work by the same author [*R.A.E.*, B, xviii, 39]; further details are given on the geographical distribution of the jerboas and fleas, but the special questions of classification are dealt with more briefly.

In the second paper the bionomics and distribution of the Spalacid rodents are discussed. The importance of these animals in relation to plague is as yet unknown, and it is very difficult to experiment with them as they usually die in captivity. A list of fleas found on them is arranged under the hosts, with short notes on their classification and distribution. *Ctenophthalmus spalacis*, J. & R., and *C. gigantospalacis*, sp. n., are the specific parasites of *Spalax microphthalmus* and *S. giganteus* respectively, and, unlike other species of *Ctenophthalmus*, are capable of biting man. A detailed description of the males and females is given.

The third paper is an account of a study of the fleas of the steppe weasel (*Putorius eversmanni*), which preys on *Citellus*, *Alactaga* and allied rodents and usually harbours their ectoparasites. Laboratory and field observations indicated that it may be infected with plague either by the bites of the fleas or through feeding on diseased animals. Epizootics of plague in weasels have often been observed during outbreaks among *Citellus*, and instances have been recorded of plague infections in people engaged in skinning dead weasels. Further investigations on the part played by *P. eversmanni* in the epidemiology of plague are urged, as the passage to it of fleas from rodents facilitates the spread of epizootics. A list is given of 11 species of fleas collected on weasels and in their nests during 1925–28 from various parts of south-eastern Russia. Of these 67 per cent. were a form of *Pulex irritans*, L., which readily attacked man. In certain characters, however, it differs from the typical *P. irritans*, and it is treated as a distinct variety, var. *fulvus*, n. Further studies are recommended to explain the association of this species with the weasel, in spite of the fact that the latter does not frequent human dwellings. The few examples of *Ctenocephalus canis*, Curt., and *C. felis*, Bch., found on weasels were probably accidental parasites that had passed to them from domestic animals, or perhaps from wolves or foxes. Other species of fleas were chiefly those common to rodents attacked by weasels.

PAPERS NOTICED BY TITLE ONLY.

MACGREGOR (M. E.). **The Artificial Feeding of Mosquitoes by a New Method which demonstrates certain Functions of the Diverticula.**—*Trans. R. Soc. Trop. Med. Hyg.*, xxiii, no. 4, pp. 329–331, 4 figs. London, 30th January 1930.

MARCHOUX (E.). **Prophylaxie du paludisme dans les Dombes et en Camargue.**—*Rev. Hyg. Méd. prév.*, li, no. 10, pp. 721–744, 2 maps, 1 ref. Paris, October 1929. [Summary already noticed, *R.A.E.*, B, xv, 137.]

FAUST (E. C.). **Mosquitoes in China and their potential Relationship to Human Disease.**—*4th Int. Cong. Ent. Ithaca, N.Y. 1928*, ii (Trans.), pp. 259–267, 1 map, 16 refs. Tring, England, 1929. [See *R.A.E.*, B, xvii, 164.]

JORDAN (K.). **On Some Problems of Distribution, Variability and Variation in North American Siphonaptera.**—*4th Int. Cong. Ent. Ithaca, N.Y. 1928*, ii (Trans.), pp. 489–499, 11 figs. Tring, England, 1929.

ENDERLEIN (G.). **Ueber den Laut-Apparat der Flöhe.** [On the Sound Apparatus in Fleas.]—*4th Int. Cong. Ent. Ithaca, N.Y. 1928*, ii (Trans.), pp. 771–772, 3 figs., 1 ref. Tring, England, 1929.

FRANCIS (E.). **Arthropods in the Transmission of Tularaemia.**—*4th Int. Cong. Ent. Ithaca, N.Y. 1928*, ii (Trans.), pp. 929–944, 7 figs., 38 refs. Tring, England, 1929. [*Cf. R.A.E.*, B, xvi, 84; xii, 123; etc.]

RUDOLFS (W.). **Environmental Factors and Mosquito Breeding.**—*4th Int. Cong. Ent. Ithaca, N.Y. 1928*, ii (Trans.), pp. 945–959, 2 figs., 5 refs. Tring, England, 1929. [*Cf. R.A.E.*, B, xvii, 86; xv, 199; etc.]

DI MATTEI (G.). **Sopra una dermatosi provocata dall'uso del "verde di Parigi" nel personale adetto alla disanofelizzazione idrica.** [A Dermatitis in the Anti-mosquito Staff due to Paris Green.]—*Riv. Malariol.*, viii, no. 6, pp. 669–673. Rome, 1929. With Summaries in Italian, p. 743, French, p. 745, English, p. 747, German, p. 749.)

DE BOISSEZON (P.). **Les réserves dans le corps gras de** *Culex pipiens* **L. et leur rôle dans la maturation des oeufs.**—*C.R. Soc. Biol.*, ciii, no. 14, pp. 1232–1233. Paris, 1930. [*Cf. R.A.E.*, B, xviii, 94.]

DE BOISSEZON (P.). **Le rôle du corps gras comme rein d'accumulation chez** *Culex pipiens* **et chez** *Theobaldia annulata.*—*C.R. Soc. Biol.*, ciii, no. 14, pp. 1233–1235. Paris, 1930.

VOGEL (R.). **Zur Kenntnis der Steckmücken Württembergs. i. Teil.** [The Mosquitos of Wurtemberg. Part i.]—*Jhft. Ver. vaterl. Naturk. Württemberg*, lxxxv, pp. 258–277, 1 fig., 2 refs. Stuttgart, 1929.

KRÖBER (O.) **Tabanidae** *in* LINDNER (E.). **Die Fliegen der Palaearktischen Region.** [The Flies of the Palaearctic Region. TABANIDAE.]—xix, Lief. 5–8, 146 pp., 3 pls., 70 figs. Stuttgart, 1925.

DINULESCU (G.). **Armature génitale mâle et femelle du** *Stomoxys calcitrans.*—*Ann. Paras. hum. comp.*, viii, no. 1, pp. 61–70, 15 figs., 4 refs. Paris, 1st January 1930.

Glaser (R. W.). **A new Flagellate** [described but not named] **form the Intestine of** *Lucilia caesar* **L.**—*J. Parasit.*, xvi, no. 3, pp. 137–139, 1 ref. Urbana, Ill., March 1930.

Cousin (G.). **La diapause de** *Lucilia sericata* **Meig.**—*C.R. Acad. Sci. Fr.*, cxc, no. 10, pp. 651–653, 3 refs. Paris, 1930. [*Cf. R.A.E.*, B, xvii, 205, 206, 240.]

Hecht (O.). **Die Hautreaktionen auf Insektenstiche als allergische Erscheinungen. iii.** [The Reactions of the Skin to the Bites of Insects as allergic Phenomena. iii.]—*Zool. Anz.*, lxxxvii, no. 9–10, pp. 231–246, 1 fig., 34 refs. Leipzig, 10th March 1930. [*Cf. R.A.E.*, B, xviii, 16, 88.]

Metcalf (M. M.). **Parasites and the Aid they give in Problems of Taxonomy, geographical Distribution, and Paleogeography.**—*Smithson. Misc. Coll.*, lxxxi, no. 8 (Pub. 3010), 36 pp., 4 figs., 3 pp. refs. Washington [D.C.], 28th February 1929.

Bagnall (R. S.). **Records of some Ectoparasites of the Otter and Badger, including a rare** *Trichodectes* [*exilis*, Nitzsch (Otter Louse)] **previously unknown as British.**—*Vasculum*, xvi, no. 1, pp. 6–9, 4 refs. Newcastle-upon-Tyne, February 1930.

André (M.). **Les pièces buccales de la nymphe du** *Thrombicula autumnalis* **Shaw.**—*Bull. Soc. Zool. Fr.*, liv, no. 5, pp. 484–489, 3 figs., 3 refs. Paris, 9th November 1929.

André (M.). **Les pièces buccales du rouget, larve du** *Thrombicula autumnalis*, **Shaw.**—*Bull. Mus. Hist. nat.*, (2) i, no. 1, pp. 100–103, 2 figs., 3 refs. Paris, January 1929.

Jordan (K.). **On Fleas collected by Dr. H. M. Jettmar in Mongolia and Manchuria in 1927 and 1928** [9 new Species and 4 new Subspecies].—*Novit. Zool.*, xxxv, no. 2, pp. 155–164, 4 pls. Tring, 30th September 1929.

Jordan (K.). **Two new African Species of** *Ctenophthalmus* **(Siphonaptera).**—*Novit. Zool.*, xxxv, no. 2, pp. 165–167, 4 figs. Tring, 30th September 1929.

Jordan (K.). **On a small Collection of Siphonaptera from the Adirondacks, with a list of the Species known from the State of New York** [1 new Species and 1 new Subspecies.]—*Novit. Zool.*, xxxv, no. 2, pp. 168–177, 4 figs. Tring, 30th September 1929.

Jordan (K.). **Some new Palaearctic Fleas** [5 new Species and 1 new Subspecies.]—*Novit. Zool.*, xxxv, no. 2, pp. 178–186, 10 figs. Tring, 30th September 1929.

De Meillon (B.). **New Fleas from South Africa** [2 new Species.]—*Novit. Zool.*, xxxv, no. 3, pp. 250–253, 9 figs. Tring, 2nd April 1930.

Jordan (K.). **Two new American Fleas.**—*Novit. Zool.*, xxxv, no. 3, pp. 268–269, 2 figs. Tring, 2nd April 1930.

[Wagner (J.).] **Вагнер (Ю. Н.). Ueber neue palaeartkische Floh-Arten (Aphaniptera). ii.** [New Palaearctic Species of Fleas. ii.]—*Annu. Mus. zool. Acad. Sci. U.R.S.S.*, xxx, pt. 4, pp. 531–547, 10 figs. Leningrad, 1930.

Colcord (M.), Hawes (I. L.) & Carabelli (A. J.). **Check List of Publications on Entomology issued by the United States Department of Agriculture through 1927** [up to 1927 inclusive], **with Subject Index.**—*Bibliogr. Contr. U.S. Dept. Agric.*, no. 20, iv+261 pp., multigraph. Washington, D.C., January 1930.

HIRST (L. F.). **Rat-flea Surveys.**—*Rep. Med. Off. Hlth. Colombo 1928*, xxiii, pp. 48–51. Colombo [1929].

A rat-flea survey instituted in Kandy in connection with an investigation of the causes of a plague outbreak that occurred there between November 1927 and February 1928 showed *Mus* (*Rattus*) *rattus kandianus* to be the most prevalent species of rat in domestic premises. The mole rat, *Gunomys gracilis*, is more common in Kandy than in Colombo, but *M.* (*R.*) *norvegicus* is entirely absent. The small number of rats present in the bazaar quarter indicated that they had been devasted by the plague epizootic. The fleas present on the rats were *Xenopsylla cheopis*, Roths., and *X. astia*, Roths., the former predominating in percentages varying from 53·9 to 85·3. Analysis of meteorological data shows that the mean monthly temperature falls within the range favourable to the propagation of *X. cheopis* (68–78° F.) throughout the year, and that the saturation deficiency only falls below the critical limit (0·3 inch) during February and March [*cf. R.A.E.*, B, xvi, 53]. The climate of Kandy, which is situated at an elevation of about 1,700 ft., is thus much cooler than that of Colombo and is therefore more favourable to the survival of plague infected rat-fleas. The *cheopis* index for the district as a whole was 2·38, as compared with the *M. rattus-cheopis* index of 1·44 for the transport warehouses in Colombo during the survey of 1922–24, and 0·83, the corresponding index for the most heavily plague-infected part of Colombo. According to the author's ideas, these figures indicate that plague epizootics in Kandy will tend to be more severe but less persistent than in Colombo. As *X. cheopis* is apparently established in the Central Province, there is no point in fumigating rice destined for the principal townships for the destruction of the eggs and larvae of this species, but in the case of Colombo and the low-country districts fumigation safeguards against transference of infection from place to place and prevents its spread into new territory by the elimination of the chief insect carrier. The advisability is pointed out of rebuilding certain goods-sheds on rat-proof lines in order to lessen the danger of the transport of plague rats from Colombo to Kandy by rail.

Fleas identified in the Kalutara rat-flea survey were all *X. astia* with the exception of one *Ctenocephalus felis*, Bch. The flea index for *M. rattus kandianus* in commercial premises was 3·4 and in residential premises 2·6. These results afford further evidence in favour of the theory that *X. astia* is the indigenous rat-flea of the low country of Ceylon.

Rat-flea surveys from 1922 to 1924 showed little or no infestation with *X. cheopis* in certain districts of Colombo that were free from plague, and further observations carried out in 1926 showed a *cheopis* index in non-plague districts of only 0·005–0·03. A more intensive survey of these districts in 1928 showed, however, a disquietingly high incidence of 10·4 per cent., whereas the incidence of *X. cheopis* in the endemic plague area reached 43·6 per cent. in that year (*cheopis* index 1·08). Although the variations in prevalence of *X. cheopis* in Colombo are not governed primarily by the slight seasonal variations in climate, the plague-transmitting power of the individual flea is markedly increased when the temperature falls below 80° F. A general re-survey of the whole city was therefore instituted, to be continued throughout the year. The gross percentage results are shown, and a detailed analysis will be given later.

(11879) Wt P5/3534 1,700 7/30 H & Sp Gp 52

The results of recent research have indicated that the spread of plague is governed by the rat-flea species factor, the flea being *X. cheopis* and the particular breeding-places grain stores, and that plague can be controlled by concentrating appropriate anti-rat and flea measures on the foci of the carrier insect. It is becoming increasingly clear that the importation of a few infected *X. cheopis* in grain or other vehicle into a zone of territory where such fleas as *X. astia* or *Ceratophyllus fasciatus*, Bosc, are indigenous may suffice to intitiate an epizootic, and that under these circumstances the less efficient carrier may temporarily enter into play. Unless *X. cheopis* becomes established on local rats, such outbreaks will be sporadic, and there will be no tendency for the disease to spread into neighbouring territories where *X. cheopis* is entirely absent. The value of laboratory experiments to determine the relative powers of transmission of *X. cheopis* and *X. astia* is discussed, and reference is made to experiments carried out at Lucknow in 1926–27 [xvi, 223]. The author, however, believes that it is impossible to represent natural conditions in the laboratory and considers that only the most exhaustive research both in the field and in the laboratory will disclose the relative parts played by insects as carriers of disease.

TITSCHACK (E.). **Untersuchungen über das Wachstum, den Nahrungsverbrauch und die Eierzeugung. iii.** *Cimex lectularius*, **L.** [Investigations as to Growth, Food-consumption and Egg-production. iii. *C. lectularius.*]—*Z. Morph. Oekol. Tiere*, xvii, no. 3, pp. 471–551, 5 figs., 39 refs. Berlin, 24th March 1930.

This is a detailed study of the effect of temperature and varying amounts of food on the length of development of *Cimex lectularius*, L., and on the number of eggs laid. The largest number deposited by any one female in the course of the investigation was 541. Pairing may occur immediately after the last moult, and fertilisation is possible throughout the life of the adult.

SPENSER (G. J.). **The Status of the Barn Swallow Bug,** *Oeciacus vicarius* **Horváth.**—*Canad. Ent.*, lxii, no. 1, pp. 20–21. Orillia, Ont., January 1930.

A few instances are recorded from Canada of *Oeciacus vicarius*, Horv., attacking man. The bugs breed freely throughout the summer in the nests of swallows and in early autumn, when the birds migrate, they invade dwellings where they may cause trouble for a few days; the infestation then dies down. In certain cases, apparently, when infestation is very heavy, invasion of dwellings from nesting areas may occur some weeks before the birds leave their nests.

DAUBNEY (R.). **Some Filtrable Virus Diseases, with particular Reference to certain Diseases of Animals in Kenya.**—*Kenya & E. Afr. Med. J.*, vi, no. 9, pp. 245–263, 14 refs. Nairobi, December 1929.

This is a review of the present state of knowledge regarding the filtrable virus diseases of man and domestic animals. The author divides these diseases into four groups, one of which comprises those

that are transmitted, or believed to be transmitted, by Arthropods, including diseases with which *Rickettsia* is associated. There is some evidence that the virus of these diseases undergoes cyclical development in the invertebrate host.

Of the diseases of the type associated with *Rickettsia*, only two are known to occur in Kenya, *viz.*, tropical typhus of man and heartwater of sheep, goats and cattle. The occurrence of *Rickettsia* in tropical typhus has not yet been demonstrated, and its vector is unknown. Heartwater has recently been transmitted experimentally to sheep by unfed adults of *Amblyomma variegatum*, F., the common bont tick of Kenya.

Of the other virus diseases known or believed to be transmitted by Arthropods, three occur in domestic animals in Kenya, *viz.*, South African horse sickness, blue-tongue of sheep and Nairobi sheep disease, which is transmitted by *Rhipicephalus appendiculatus*, Neum. [*R.A.E.*, B, v, 76]. South African horse sickness and blue-tongue have a very similar distribution in Kenya, and it is suspected that both are transmitted by mosquitos.

DE FARÍA (J. G.). **Estudios sobre la tristeza de los bovinos. Piroplasmosis y anaplasmosis.** [Studies on bovine Piroplasmosis and Anaplasmosis.]—*Rev. Inst. bact.*, v, no. 4, pp. 429–469, 11 pls. Buenos Aires, November 1928. [Recd. 1930.]

These preliminary investigations were made in 1927 in Rio de Janeiro and in 1928 in Buenos Aires, where healthy, non-immune cattle were available in a tick-free area. The first part of the paper deals with *Babesia argentina* (*minor*) and *Piroplasma bigeminum*, both of which occur in Brazil and Argentina. Infection with *B. argentina* was produced in Buenos Aires by larvae from eggs of adult females of *Boophilus* (*Margaropus*) *annulatus australis*, Fuller, taken in Brazil in areas where cattle were heavily infected with piroplasmosis and anaplasmosis. A description of *B. argentina* is given, the differences between it and *P. bigeminum* are indicated, and its systematic position is discussed. The second part of the paper deals with cross-immunity experiments, and the third with anaplasmosis. It was confirmed that pure infections of this disease can be obtained, and that it is quite distinct from piroplasmosis. Attempts to transmit it by means of ticks proved unsuccessful.

MCCARTHY (D. D.). **Medical Notes from Weti, Pemba.**—*Trans. R. Soc. Trop. Med. Hyg.*, xxiii, no. 4, pp. 401–412. London, 30th January 1930.

These notes include accounts of malaria and filariasis, which are common among the natives of Pemba. Anopheline mosquitos breed freely in several swamps surrounding the township of Weti, the most common species found in houses being *Anopheles gambiae*, Giles (*costalis*, Theo.). *A. funestus*, Giles, and *A. maculipalpis*, Giles, are comparatively rare.

The majority of rats caught in a survey at Weti were either *Mus* (*Rattus*) *rattus* or *Mus* (*Epimys*) *norvegicus*. Of 571 fleas taken on them, 570 were *Xenopsylla braziliensis*, Baker, and only one *X. cheopis*, Roths. The rarity of the latter is remarkable, as it constitutes more than half the number of rat-fleas in Zanzibar [*R.A.E.*, B, xvii, 88].

Mills (E. A.), MacHattie (C.) & Chadwick (C. R.). **A preliminary Note on the Relationship of the Parasites of human and canine dermal Leishmaniasis.**—*Trans. R. Soc. Trop. Med. Hyg.*, xxiii, no. 4, pp. 413–416, 2 pls., 3 refs. London, 30th January 1930.

Studies of canine and human infection with dermal leishmaniasis in Iraq, and particularly in Baghdad, have shown both to have a similar seasonal incidence and local distribution. In both cases infection occurs in the unprotected part of the body. It has been shown by other writers that *Phlebotomus sergenti*, Parrot, and *P. papatasii*, Scop., are in all probability vectors of *Leishmania tropica* in the case of human oriental sore, and the authors have demonstrated that both these sandflies can be infected by feeding on cultures of leishmania isolated from canine lesions. Both these species feed readily when placed on a dog's nose under experimental conditions. Experiments on the serological reactions, which are described, appear to indicate a very close relationship, if not actual identity, of the *Leishmania* producing cutaneous infection in man and dogs as seen in Iraq.

MacHattie (C.) & Chadwick (C. R.). **Notes on a Trypanosome Infection of the Dog Tick *Rhipicephalus sanguineus* in Iraq.**—*Trans. R. Soc. Trop. Med. Hyg.*, xxiii, no. 4, pp. 417–419, 1 pl., 6 refs. London, January 1930.

The occurrence of natural infection of ticks with flagellates is reviewed from the literature, which records only four instances [*cf. R.A.E.*, B, ii, 45; xii, 189]. Experimentally fed ticks have been observed to harbour flagellates in one case [xii, 101].

A flagellate infection of *Rhipicephalus sanguineus*, Latr., removed from a dog is described from Baghdad. The flagellates occurred in two ticks out of six that were feeding on areas between and around healing sores that had been previously shown to contain *Leishmania tropica*. They are possibly identical with *Crithidia christophersi*, which was described from films of the intestine of the same tick from India in 1907. As cultures of the dog's blood gave negative results, and post-mortem examination failed to show any trace of leishmania or trypanosomes, while only two ticks were found infected, it appears possible that the infection was derived from some unknown host, possibly a small rodent, on which the ticks had previously fed.

Davenport (C.). **A Note on the Occurrence of *Hypoderma crossi* in Goats in Baluchistan and the Question of the Fitness of the Meat for human Consumption.**—*Trans. R. Soc. Trop. Med. Hyg.*, xxiii, no. 4, pp. 425–426, 3 refs. London, January 1930.

About 90 per cent. of the goats supplied for food to troops in Quetta, Baluchistan, were found to be heavily infected with cutaneous myiasis, many showing up to 50 lesions each. Most of the lesions were situated in the region of the spine and contained larvae that proved to be *Hypoderma crossi*, Patton. Infestation of goats by this fly is well known in Northern India, but this is apparently the first record of its occurrence in Baluchistan. Although the goats in question are believed to have been locally bred, the available evidence does not warrant the conclusion that *H. crossi* is necessarily indigenous to the

country, as herds of goats are known to traverse great distances on the North-west Frontier. A careful dissection of the carcases showed them to be entirely unaffected, all the larvae, which occurred subcutaneously in close association with the skin, coming away with it in the process of skinning. The meat was therefore passed as fit for human consumption.

SEEGERT (J.). **Untersuchungen über Mal de Cadeiras, ihre Behandlung mit Naganol-Antimosan und die Frage der Uebertragung.** [Investigations on Mal de Caderas, its Treatment with Naganol-Antimosan and the Question of Transmission.]—*Arch. Schiffs- u. Tropenhyg.*, xxxiv, no. 2, pp. 99–123, 14 figs. Leipzig, February 1930.

It has been suggested that Tabanids are the vectors of the form of equine trypanosomiasis in Brazil known as mal de caderas, but a wire fence that keeps infected horses apart from healthy ones suffices to prevent the latter from being infected. Von Bassewitz has suggested that leeches are the vectors [*R.A.E.*, B, viii, 102], and the author has found trypanosomes in leeches taken in a place where infected horses were watered.

ANDRÉ (M.). **Digestion " extra-intestinale " chez le rouget** (*Leptus autumnalis* **Shaw**).—*Bull. Mus. Hist. nat.*, xxxiii, no. 6, pp. 509–515, 2 figs., 23 refs. Paris, November 1927.

The author discusses the manner in which the larva of *Trombicula* (*Leptus*) *autumnalis*, Shaw, absorbs nourishment from its host, and distinguishes in the process of biting two distinct actions : firstly, the ejection by the larva of a digestive juice capable of dissolving the adjacent tissues and of a secretion that forms a suction tube ; and, secondly, the sucking up of the liquid produced by the dissolution of the host tissues. The ejection of digestive secretions into the wounds would account for the peculiar persistence of the irritation produced by the bite of this mite.

ANDRÉ (M.). **Sur quelques nouveaux cas d'observation du** *Leptus autumnalis* **Shaw.**—*Bull. Soc. zool. Fr.*, lii, no. 5, pp. 313–319, 2 figs., 9 refs. Paris, 15th December 1927.

In spite of the observations of himself and others [*cf. R.A.E.*, B, xv, 218] that the larvae of *Trombicula* (*Leptus*) *autumnalis*, Shaw, and adults of *Allothrombium fuliginosum*, Herm., are found together, the author maintains them to be distinct species. The presence of the larvae of *A. fuliginosum* on warm-blooded animals has not yet been authenticated. The observations of others that the only harvest mites recorded from vertebrates are larvae that have a single dorsal shield and belong to the group of *T. autumnalis* are confirmed.

ANDRÉ (M.). **Recherches sur le développement post-larvaire du rouget** (*Leptus autumnalis* **Shaw**).—*C. R. Acad. Sci. Fr.*, clxxxvii, no. 19, pp. 842–844, 2 figs., 4 refs. Paris, 1928.

Numbers of larvae of *Trombicula* (*Leptus*) *autumnalis*, Shaw, were collected by the author in France from fields of kidney beans and

placed on a rabbit, chiefly about the ears. After 70 hours the mites were removed and put into a vessel containing sterilised soil and in which the air was completely saturated. They buried themselves in the soil, and 33 days later 14 active nymphs were found, the characters of which referred them indisputably to the genus *Trombicula*.

ANDRÉ (M.). **Observations biologiques sur la larve du** *Thrombicula autumnalis* **Shaw.**—*Bull. Soc. zool. Fr.*, liii, no. 6, pp. 368–370. 3 refs. Paris, 10th December 1928.

Further investigations support the view that the larva of *Trombicula* (*Leptus*) *autumnalis*, Shaw, a parasite of vertebrates only and possessing only one dorsal shield, cannot be that of *Allothrombium fuliginosum*, Herm., which the author has never found, except on Aphids, and which has two dorsal shields. The larvae of *Trombicula* appear more than a month after those of *Allothrombium*, which transform into nymphs from the end of July, whereas it is not till mid-October that *T. autumnalis* reaches its nymphal stage.

ANDRÉ (M.). **Note sur le genre** *Thrombicula* **Berlese, 1905.**—*Bull. Mus. Hist. nat.*, xxxiv, no. 3, pp. 208–211, 2 refs. Paris, 1928.

A list is given of species of *Trombicula* recorded from various countries. In Europe only *T. canestrinii*, Buffa, *T. formicarum*, Berl., and *T. autumnalis*, Shaw (of which the author treats *T. inopinata*, Oudms., as a synonym [*cf. R.A.E.*, B, xvi, 47]) are known.

METHLAGL (A.). **Ueber die Trombidiose in den Oesterreichischen Alpenländern.** [Trombidiosis in the Austrian Alps.]—*Denkschr. Akad. Wiss. Wien.*, Mat.-naturw. Cl., ci, pp. 213–249, 36 figs., 38 refs. Vienna, 1928.

The larval harvest mites attacking man in Austria are *Trombicula desaleri*, sp. n., in South Tyrol, *T. autumnalis*, Shaw, in Lower Austria, and near Vienna, and *Polydiscia squamata*, gen. et sp. n., near Vienna. The new species are described. Two other new larvae are also described, one of which is referred to a new genus. The author considers that many of the species of the larval genus *Trombicula* (*Microtrombidium*) are merely local races, which may be divided into groups allied to *T. wichmanni*, Oud., and *T. autumnalis*, Shaw. There are also between these groups forms, including *T. akamushi*, Brumpt, that cannot yet be assigned to either. The number of the larvae varies considerably, so that in many years little or no infestation occurs. No adults of *Trombicula* were found in the districts investigated.

ANDRÉ (M.). **Description d'une forme adulte du rouget** (*Thrombicula autumnalis* **Shaw**).—*Bull. Mus. Hist. nat.*, (2) i, no. 6, pp. 394–400, 3 figs., 2 refs. Paris, November 1929.

The adult form of *Trombicula* (*Leptus*) *autumnalis*, Shaw, a stage hitherto unknown and found by the author in the soil on strawberry in France, is described and figured. Numbers of the larvae occurred on the lower surface of the leaves.

Blanc (G.) & Caminopetros (J.). **La transmission des varioles aviaires par les moustiques.**—*C.R. Acad. Sci. Fr.*, cxc, no. 15, pp. 954–956, 1 ref. Paris, 1930.

Experiments carried out by the authors demonstrated that *Culex pipiens*, L., after biting fowls suffering from avian variola (fowl-pox) could infect healthy ones as long as 58 days after becoming infective and probably, therefore, during their whole life. A similar result was obtained in the case of pigeons, the infection in both instances showing the same clinical symptoms as are observed in nature. In both birds, also, the bite of the infected mosquito may be followed by an infection that is not clinically discernible, but that is sufficient to confer immunity.

Bushnell (L. D.) & Brandly (C. A.). **Poultry Diseases, their Prevention and Control.**—*Bull. Kansas Agric. Expt. Sta.*, no. 247, 107 pp., 32 figs., 22 refs. Manhattan, Kans., June 1929.

This is a revision of a previous circular [*R.A.E.*, B, xiii, 21]. As the result of recent experiments in Kansas, the use of nicotine sulphate against lice, *Liponyssus bursa*, Berl. (tropical mite) and *Dermanyssus gallinae*, DeG. (chicken mite) on fowls is recommended ; a thin line of the liquid is poured or brushed on to the perches sufficiently early in the day for it to dry before the birds go to roost, when the warmth of their bodies causes the nicotine to volatilise. At least three treatments are needed against *L. bursa* [this is probably the mite recorded in a previous abstract as *L. sylviarum*, C. & F., *R.A.E.*, B, xviii, 21].

André (M.). **Contribution à l'étude d'un acarien : le *Thrombicula autumnalis* Shaw.**—*Mém. Soc. zool. Fr.*, xxix, no. 2, pp. 39–138, 25 figs., 5 pp. refs. Paris, 31st March 1930.

The literature on *Trombicula* (*Leptus*) *autumnalis*, Shaw, is reviewed, and its bionomics and synonymy and the effect of its attacks on man and domestic animals are discussed. The larva and its method of feeding, the female nymph and an adult female, believed to be *T. autumnalis*, are described in detail. Much of the more important information has appeared in papers dealing with individual aspects of the work [*R.A.E.*, B, xviii, 120, 125, 126]. The author considers that *T. autumnalis* is the only harvest mite that certainly attacks man in France and Europe generally ; it infests mammals and birds, and man is only an accidental host.

In the lowlands of France, the larva of *T. autumnalis* is found at the end of August and in the first half of September, when it must attach itself to a warm-blooded vertebrate in order to continue its development. The larvae occur in restricted foci, always where the soil is moist ; the author considers that they only crawl on to herbaceous plants accidentally, and never on to bushes. After feeding, the larva leaves its host, and burrows into the earth, where it transforms into a nymph ; in the laboratory, this occurred about the middle of October. Both the nymph and the adult probably live in the soil, and not, as has been suggested, in the burrows of rodents. In mountainous regions, the larvae appear somewhat later, and hibernation probably takes place in the larval stage.

CHANDLER (A. C.). **Introduction to Human Parasitology.**—Demy 8vo, 4th edn., xiv+655 pp., 308 figs. New York, John Wiley & Sons, Inc.; London, Chapman & Hall, Ltd., 1930. Price, 25*s.* net.

This is the 4th edition of a work that has previously appeared under the title "Animal Parasites and Human Disease" [*R.A.E.*, B, vi, 113; xi, 86; xiv, 166], but its scope has been somewhat changed. From being a popular treatise, the book has been re-written and re-arranged and is now offered as a textbook that will serve as an introduction for students, particularly those going on to medical or public health work. It is divided into three main sections, dealing with Protozoa, Helminths and Arthropods, and the author's aim has been to give a knowledge of fundamental facts and principles rather than a mere compilation of selected, important details, special emphasis being laid throughout on the biological aspects of the subject.

[KHODUKIN (N. I.).] **Ходукин (Н. И.). On the Intestinal Protozoa of** *Phlebotomus*. [*In Russian.*]—*Meditz. Muisl' Uzbekistana*, ii (vii), no. 1, pp. 83–87, 1 fig., 4 refs. Tashkent, October 1927. (With a Summary in German, p. 129.)

In the summer of 1926, the author examined the intestinal tract, pharynx and buccal cavity of 340 female sandflies taken in Bokhara, mostly in houses inhabited by people suffering from visceral or dermal leishmaniasis. The species of *Phlebotomus* found in Bokhara are *P. papatasii*, Scop., *P. minutus*, Rond., *P. major* var. *perniciosus*, Newst., *P. caucasicus*, Marz. (*li*, Popov), and *P. sergenti*, Parrot (*caucasicus*, auct.), but the author was able to identify the females of *P. papatasii* and *P. minutus* only. The method of dissecting them is described. Protozoa were found in three of them, namely a trypanosome accompanied by some herpetomonad and crithidial forms in two unidentified sandflies, and L.D. bodies of (?) *Leishmania tropica* in one female of *P. papatasii* out of 22 taken in a room occupied by persons infected with dermal leishmaniasis. The trypanosome is described as *Trypanosoma phlebotomi*, sp. n.

Examination of 160 female sandflies from Tashkent, where *P. papatasii*, *P. major* var. *perniciosus* and *P. sergenti* occur, gave negative results, although they were taken in districts known as foci of infantile and canine leishmaniasis.

[KHODUKIN (N. I.).] **Ходукин (Н. И.). On the Protozoa of the Intestines of canine Fleas in Tashkent and their Rôle in the Epidemiology of canine Leishmaniasis.** [*In Russian.*]—*Meditz. Muisl' Uzbekistana*, ii (vii), no. 3, pp. 69–73, 8 refs. Tashkent, December 1927. (With a Summary in French, p. 136.)

This paper gives fuller details of a study carried out in 1926 in Tashkent on the relation of fleas found on dogs to canine leishmaniasis than one already noticed [*R.A.E.*, B, xvii, 9–10]. The literature on the subject is reviewed. Dissection of numbers of *Ctenocephalus canis*, Curt., *C. felis*, Bch., and *Pulex irritans*, L., revealed that about 14 per cent. of the fleas contained flagellates irrespective of whether they were taken on diseased or healthy dogs, the percentage of infected individuals

being even a little higher in the latter case. The flagellates were morphologically different from those of *Leishmania*, and were also less numerous in the fleas in May when the epidemic among dogs reached its peak. Over 3 per cent. of the flea larvae contained *Herpetomonas ctenocephali*, but no protozoa were found in those reared under conditions that prevented them from feeding on the faeces of the adults. The author concludes that *H. ctenocephali* is transmitted from the adult flea to the larva and that the fleas have no relation to canine leishmaniasis.

[Averbukh (I. Ya.).] **Авербух (И. Я.). On the Study of the Rôle of** *An. pulcherrimus* **(Theob.) in the Epidemiology of Malaria.** [*In Russian.*]—*Meditz. Muisl' Uzbekistana*, ii (vii), no. 5, pp. 21–25, 4 refs. Tashkent, February 1928. (With a Summary in English, p. 92.)

The literature on the relation of *Anopheles pulcherrimus*, Theo., to malaria is briefly reviewed. In experiments in 1927 in Kazakstan, laboratory bred adults were in several instances successfully infected with *Plasmodium vivax* by feeding on malaria cases. Oocysts developed on the eighth day at a temperature of 26–30° C. [78·8–86° F.], and on the 14th day sporozoites occurred in the salivary glands. An attempt to transmit malaria to man by the bite of an artificially infected individual was unsuccessful.

[Shevchenko (F. I.).] **Шевченко (Ф. И.). Does** *Phlebotomus duboscquii* **exist as a distinct Species?** [*In Russian.*]—*Meditz. Muisl' Uzbekistana*, ii (vii), no. 9–10, pp. 27–30, 4 figs., 1 ref. Tashkent, June–July 1928. (With a Summary in German, p. 97.)

The author considers *Phlebotomus duboscqui*, Nev.-Lem., to be merely a variety of *P. papatasii*, Scop. The distinction between these two sandflies was based on the number of spines on the lower clasper of the male, but examination of 542 individuals taken in Tashkent showed that the number is variable and cannot be considered of specific value.

[Akhundov (I.).] **Ахундов (И.). The** *Phlebotomus* **Fauna of some of the Districts in Azerbaijan.** [*In Russian.*]—*Arch. Inst. Microb. Hyg. Azerb.*, i, no. 1–2, pp. 136–137, 7 refs. Baku, 1929. (With a Summary in German, p. 156.)

The sandflies taken in the summer of 1928 in three different districts in western Azerbaijan were *P. major* var. *perniciosus*, Newst., which was much the most numerous, *P. sergenti*, Parrot, and *P. papatasii*, Scop. Reference is made to other species previously recorded as occurring in Transcaucasia [*R.A.E.*, B, xiv, 54, 134; xv, 152].

Legendre (J.). **La zoophilie des phlébotomes en Saintonge.**—*Bull. Acad. Méd.*, (3) cii, no. 34, pp. 238–240. Paris, 4th November 1929.

Further observations in Saintonge (Charente-Inférieure) where the author recorded *Phlebotomus major* var. *perniciosus*, Newst., in 1924 [*R.A.E.*, B, xiii, 35] were made in 1929. In five weeks 42 females and 5 males were taken in a recently erected fowl house, the females being

engorged. Very few were seen in the dwelling, and the protection enjoyed by the inmates was probably due to the proximity of the fowl house. It is not known whether this sandfly, which has been found elsewhere in Charente-Inférieure [xv, 29], is indigenous to France or has been imported.

KNOWLES (R.). **The Kala-azar Transmission Problem and the Factor of Resistance.**—*Trans. 7th Cong. Far East. Ass. Trop. Med. 1927*, iii, pp. 1–11, 51 refs. Calcutta [1930].

The history of the discovery that sandflies (*Phlebotomus*) are almost certainly the vectors of kala-azar is reviewed. The transmission of the disease from man to man, or to an experimental animal by the bite of an infected sandfly has not yet been accomplished, and the author suggests that the failure to obtain this final proof is that man, and even more so, experimental animals, far from being readily susceptible to infection, are extraordinarily resistant. It is pointed out that epidemics of kala-azar occurred in Assam when the economic conditions had been reduced by an earthquake, and after a pandemic of influenza had seriously lowered the vitality of the population. Moreover, it has been found that attacks of kala-azar frequently follow when the resistance of an individual has been lowered by another disease, particularly typhoid or malaria. In the condition of dermal leishmanoid, it would appear that the individual's powers of resistance are such that the parasite is incapable of producing visceral infection, but lodges in the fine capillary plexus underlying the skin and causes a local lesion. In addition, the uncertainty and difficulty with which kala-azar is transmitted to experimental animals is remarkable, not more than about 10–15 per cent. contracting the disease even under the most favourable circumstances. It thus appears possible that in endemic areas the population in general may be inoculated with *Leishmania donovani*, and in the majority of persons the parasite may never cause any symptoms. In several cases recorded in the literature, infection has apparently remained latent for some years. The author therefore concludes that before transmission to man or animals can be obtained, the factor of resistance must be studied and overcome.

YOUNG (C. W.) & HERTIG (M.). **Kala-azar Studies in North China.**—*Trans. 7th Cong. Far East. Ass. Trop. Med. 1927*, iii, pp. 19–33, 12 refs. Calcutta [1930].

A brief summary is given of studies on the transmission of kala-azar carried out in China from 1924 to 1927 [*cf. R.A.E.*, B, xv, 177; xvii, 86, 208]. Attempts to transmit the disease by means of fleas of the genera *Pulex*, *Xenopsylla*, *Ceratophyllus* and *Ctenocephalus*; *Cimex lectularius*, L., and *C. pipistrelli*, Jen.; and *Phlebotomus chinensis*, Newst., and *P. sergenti* var. [*mongolensis*, Sinton] have been uniformly negative, with one exception when infection was produced in 23 per cent. of 180 hamsters inoculated intraperitoneally with infected sandflies. With one exception, in the case of a striped hamster (*Cricetulus griseus*), no naturally infected wild rodents have been encountered in the endemic region in China, nor have insects naturally infected with *Leishmania donovani* been found.

STOOKES (V. A.). **Some *Anopheles* of Sarawak.**—*Trans. 7th Cong. Far East. Ass. Trop. Med. 1927*, iii, pp. 103–115, 1 map, 1 fldg. chart, 1 pl., 15 refs. Calcutta [1930].

Notes are given on the Anophelines observed at Miri on the coast of Sarawak, where the presence of an important oilfield has necessitated anti-malarial work. The climate varies little, the average temperature ranging from 70 to 98° F. and the relative humidity from 76 to 100 per cent. Heavy rains occur throughout the year, but are most common between October and February, the average annual rainfall for the past 5 years being 117 inches. The oilfield stretches for about 12 miles along the coast, does not reach more than 4½ miles inland, and is bounded on the south-east by a low range of hills scored by ravines containing streams, of which some are hidden by jungle. The soil between the hills and sea consists of peaty loam, sand and clay, formerly covered with jungle and patches of mangrove swamp. Malaria was at one time very prevalent, but has decreased considerably.

Of the species found, *Anopheles brevipalpis*, Roper, was observed in small numbers in 1923 and 1924, since when the jungle has been cleared of their breeding-places and no more have been seen. *A. barbirostris*, Wulp, which was formerly present in considerable numbers, is now very scarce, the larvae being found in grassy pools and overgrown stagnant drains, usually in deep shade. Dissections carried out in 1924 showed no malaria parasites in either stomach or salivary glands, and it is probable that this species plays little part in the transmission of the disease. *A. umbrosus*, Theo., was formerly common and probably originated an outbreak of malaria in 1922 and participated in a subsequent one in 1923, but since 1924 only two adults have been seen. The larvae of mosquitos tentatively identified as *Anopheles hyrcanus* var. *sinensis*, Wied., and possibly also *A. separatus*, Leic., were very common 5–6 years ago in every shaded collection of water, and although the adults, the characters of which are discussed, were not frequently seen in houses, there was a considerable amount of malaria in all dwellings close to such breeding-places, the abolition of which has been followed by a marked reduction of the disease. *A. albotaeniatus*, Theo., is recorded for the first time in Sarawak. It is not known to transmit malaria, and only eight adults were obtained, all bred from larvae taken in August 1927 from stagnant water exposed to the sun.

A. ludlowi, Theo., sometimes occurs in very large numbers and is the most important carrier of malaria, although its distribution is very restricted. The larvae breed in swampy pools just above ordinary high-tide level, stagnant drains, wells and artificial containers, all exposed to sunlight. Tables are given showing the seasonal variation in the numbers of this mosquito and the corresponding fluctuation in malaria. Dissections carried out in 1924 showed 13·6 per cent. to harbour malaria parasites in the stomach. An account is given of the control measures employed and of the relation between excessively high tides that flood the breeding pools and decreases in the number of mosquitos present in them. An attempt will be made to control *A. ludlowi* by artificial flooding of the breeding-places with salt water. *A. leucosphyrus*, Dön., which has been for several years confined to the hills, has been constantly observed on the mosquito nets in the coolie lines in the early morning but does not remain there all day. There is no fixed breeding season, but the greatest numbers occur during the wettest months. The larvae may be found after heavy rains in pools

of clean water that are dry in fine weather, but the normal breeding-places are probably in the jungle. They have occasionally been found in tins associated with *A. tessellatus*, Theo., and in 1927 for the first time in the same pool with *A. albotaeniatus* at the foot of the hills. A few cases of malaria have occurred in the coolie lines on the hill-tops at times when *A. leucosphyrus* was abundant, the only other species found being an occasional *A. barbirostris*. Although dissection has not been possible, it is suspected that the former is an efficient carrier.

The adults of *A. tessellatus* are rarely seen in houses even when the larvae are abundant. The breeding season does not appear to correspond with wet weather, and the larvae are commonly found, in company with *A. hyrcanus* var. *sinensis* and *A. leucosphyrus*, in small pools and stagnant drains containing vegetation, although previously classified as swamp breeders [*R.A.E.*, B, ix, 74]. There appears to be no connection between the occurrence of *A. tessellatus* in Sarawak and malaria. *A. kochi*, Dön., is one of the commonest species, the larvae being found in small pools near the shore, in inland gardens and even on the top of the hills. They are rarely found with those of other species and increase in numbers with heavy rains. *A. kochi* does not seem to be of importance as a carrier of malaria, but was fairly numerous together with *A. umbrosus*, during a small outbreak in 1923. None of the females then caught were, however, found to be infected, and it has since been numerous in the same locality in the absence of malaria. It is remarkable that neither *A. karwari*, James, which has been previously recorded from Sarawak, nor *A. maculatus*, Theo., which has been responsible for much malaria 200 miles south of this point, was found during this investigation.

IYENGAR (M. O. T.). **Regional Distribution of Anophelines and Malaria in Bengal.**—*Trans. 7th Cong. Far East. Ass. Trop. Med. 1927*, iii, pp. 116–127, 2 charts. Calcutta [1930].

The province of Bengal is divided, according to physical features, into six regions : the montane, sub-montane, pastural, upper and lower deltaic, and estuarine. The characteristics of each of these zones are discussed, and the habits of the Anophelines and the prevalence of malaria in them are indicated. In the montane zone the nature of the country provides very few breeding-places for Anophelines, and the only known vector there is *Anopheles willmori*, James. The sub-montane region is extremely malarious, owing partly to the intensity of mosquito breeding in the wet season and also to the accumulation of labour in the tea plantations. The species of mosquito breeding in the open are virulent carriers, whereas those breeding in the forests do not transmit the disease. The diversion of streams for rice cultivation produces dangerous breeding-places in this zone. In the pastural region there is very little malaria, on account of the porous soil and the facilities for quick drainage, but certain endemic areas occur where there is much impounding of water for irrigation. The upper deltaic zone consists of a western part in which the land has been raised beyond flood influence, and an eastern part that remains low and subject to extensive flooding during rains. The eastern part is not malarious, whereas the western is notorious for its high malarial endemicity. The nearness of the water in this deltaic tract corresponds with freedom from malaria, a contrast to the conditions found in the pastural zone. The

rare occasions on which the flood breaks through in the western area prove beneficial to the health of the population. In the lower deltaic zone the country is only a few feet above sea-level, and the depressions are mostly below high-tide level. Those areas subject to tidal influence are invariably healthy, and those out of reach of the tide are flooded with water in the rainy season and have also been found to be quite non-malarious. The banks of the river, however, are elevated above high-tide level, and are usually endemic local areas. Regions from which the water has been excluded by embankments have become malarious in some cases [*cf. R.A.E.*, B, xviii, 31]. In the estuarine zone no Anophelines have been found to breed in areas subject to tidal flooding, but numerous species breed freely within the embanked and protected area, and extensive breeding-places of *A. ludlowi*, Theo., a characteristic estuarine species not observed elsewhere in Bengal, have been found on the land side of embankments in regions cleared for the purpose of rice cultivation, which are highly malarious. Within the forests and in areas where natural conditions have not been modified, however, there are no breeding grounds of this species. The entire area is so impregnated with salt that there are very few collections of water that are not brackish.

A list is given of the Anophelines hitherto recorded in Bengal, and their range of distribution in relation to these six regions is indicated. Of the five widely distributed species *A. subpictus*, Grassi, and *A. vagus*, Dön., range from the montane to the estuarine, but the former is more prevalent in the deltaic regions and the latter in the upper ones. *A. fuliginosus*, Giles, *A. barbirostris*, Wulp, and *A. hyrcanus* var. *sinensis*, Wied., have a similarly wide range. Of the less widely distributed species, *A. gigas*, Giles, and *A. lindesayi*, Giles, are confined to the montane zone ; *A. annandalei*, Prashad, and *A. willmori*, James, are montane but frequently extend into the sub-montane region ; *A. minimus*, Theo., *A. karwari*, James, *A. leucosphyrus*, Dön., *A. maculatus*, Theo., *A. kochi*, Dön., and *A. jeyporiensis*, James, are typically sub-montane ; *A. theobaldi*, Giles, has a wide range from the sub-montane to the upper deltaic, but occurs chiefly in the pastural zone ; *A. culicifacies*, Giles, starts in the lower sub-montane and extends through pastural and upper deltaic to a portion of the lower deltaic, but occurs most profusely in the pastural zone ; *A. pallidus*, Theo., is chiefly pastural but extends into the upper deltaic ; *A. listoni*, List., and *A. maculipalpis*, Giles, are confined to the pastural zone ; *A. stephensi*, List., is pastural and upper deltaic ; *A. philippinensis*, Ludl., and *A. pseudojamesi*, Strck. & Chd., are present in the upper and lower deltaic zones ; *A. minimus* var. *varuna*, Iyengar, and *A. tessellatus*, Theo., are of a similar distribution, but extend somewhat into the pastural ; and *A. ludlowi*, Theo., is confined to the estuarine zone.

IYENGAR (M. O. T.). **Parasitic Nematodes of *Anopheles* in Bengal.**—*Trans. 7th Cong. Far East. Ass. Trop. Med. 1927*, iii, pp. 128–135, 1 pl., 1 ref. Calcutta [1930].

In the course of routine identification of Anopheline larvae, a larva of *Anopheles minimus* var. *varuna*, Iyengar, was found to be parasitised by a Nematode of the genus *Mermis*. Other species of Anophelines found subject to attack by these worms in the rural areas of the Lower Bengal Delta were : *A. pseudojamesi*, Strck. & Chd., *A. hyrcanus* var. *irrequieta*, Wlk., *Calliphora erythrocephala*, Mg., and *Lucilia sericata*,

sinensis, Wied., *A. barbirostris*, Wulp, *A. fuliginosus*, Giles, *A. philippinensis*, Ludl., and *A. tessellatus*, Theo. A description is given of the worm and of its development within the host. In all instances hitherto observed in nature only one worm emerges from a single larva, the host being killed instantaneously when emergence takes place. An account is given of experimental breeding of worms that had emerged or were dissected from Anopheline larvae. The embryos, when kept alive on a wet sand slope with a little water at the base of the dish, became sexually mature within 3 weeks.

The manner in which the young worm moves on the surface of the water and holds the Anopheline larva so as to be able to penetrate its body is described. In the host it grows rapidly, imbibing nutriment through its skin from the coelomic fluid in which it lives. In laboratory experiments as many as 20 *Mermis* embryos effected their entry into a single Anopheline larva in the course of one night of exposure, but the number in the infected larvae grew less day by day until after 4 days only one was found in each. It was observed that in some ponds Anopheline larvae were heavily parasitised, whereas in others they were free from infestation. It is proposed to experiment on the possibility of infecting other ponds with Nematodes and their embryos taken from parasitised larvae. Certain other larger species of *Mermis* have been found parasitising adult mosquitos in Bengal. As in the case of the larval parasites, these Nematodes are sexually immature at the time of emergence from the host, which dies instantaneously. As they complete their development in water or wet earth, the worms only emerge from the mosquito when it is close to water. The species hitherto found infected in the adult stage are *A. fuliginosus* and *A. subpictus*, Grassi.

In the course of the subsequent discussion the author stated that the Anopheline larva is normally infested in the first instar or in the early part of the second, the more mature larvae being apparently resistant to attack. The worm always leaves the larva before it has completely matured, and no parasitised larva has been seen to pupate.

IYENGAR (M. O. T.). **Microsporidian Parasites of *Anopheles* Larvae.**—*Trans. 7th Cong. Far East. Ass. Trop. Med. 1927*, iii, pp. 136–142, 1 pl., 2 figs., 2 refs. Calcutta [1930].

Parasitisation by microsporidia of the genus *Thelohania* causes considerable mortality among Anopheline larvae in Lower Bengal at certain seasons of the year, the species subject to infection being *Anopheles minimus* var. *varuna*, Iyengar, *A. pseudojamesi*, Strck. & Chd., *A. fuliginosus*, Giles, *A. barbirostris*, Wulp, *A. hyrcanus*, Pall., and *A. subpictus*, Grassi. Some three undetermined species of *Thelohania* appear to be concerned, and other species of Anophelines in Bengal are probably liable to attack. The progress of the infection within the larva and the changes produced in its appearance are described, and an account is given of the technique employed in examining parasitised larvae. By cutting serial sections of the larvae, it was found that the parasites were confined to the fat-body. Their rate of growth and development in the body of the host is remarkably rapid. Infection usually takes place during the first 3 or 4 days of life, and by about the 12th day a considerable portion of the body has been invaded. The larvae die without undergoing any further development ; on the disintegration of the body the spores are liberated into

the water, and fresh infection occurs when they are swallowed by healthy Anopheline larvae. An account is given of detailed life-history studies of the species of *Thelohania* infecting larvae of *Anopheles pseudojamesi*, which are compared with those of *T. legeri* by Kudo [*R.A.E.*, B, xiv, 18]. This genus has never before been recorded from any species of *Anopheles* in India.

TAYLOR (F. H.). **The *Anopheles* of the Australian Region, their Bionomics and their Distribution.**—*Trans. 7th Cong. Far East. Ass. Trop. Med. 1927*, iii, pp. 143–164, 1 map, 41 refs. Calcutta [1930].

Descriptions are given of the adults, and in most cases of the larvae and pupae, of the Anophelines known to occur in Australia, New Guinea and the neighbouring islands, with notes on their synonymy, bionomics, geographical distribution and relation to malaria. Their distribution on the mainland of Australia is shown on a map. The mosquitos dealt with are *Anopheles bancrofti*, Giles, from Queensland, North Australia, New Guinea and the Admiralty Islands ; *A. stigmaticus*, Skuse, and *A. atratipes*, Skuse, both from New South Wales and southern Queensland ; *A. annulipes*, Wlk., of which the author treats *A. mastersi*, Skuse, as a synonym, from Queensland, New South Wales, Victoria, Tasmania, South Australia, Central Australia and the southern part of Western Australia ; *A. amictus*, Edw., which has sometimes been confused with *A. annulipes*, and which has probably been recorded under that name from North Australia [*R.A.E.*, B, x, 232] ; *A. punctulatus*, Dön., and *A. punctulatus* var. *moluccensis*, Swell., both from North Australia [xiii, 145], New Guinea, New Britain, etc. ; *A. subpictus*, Grassi, from Papua ; and *A. bironelli*, Christophers (*Bironella gracilis*, Theo.), from New Guinea and New Britain.

A. punctulatus and *A. punctulatus* var. *moluccensis* are the vectors of malaria in New Britain [xii, 38], and the author considers that one or both of these forms has probably been responsible for malaria epidemics in northern Australia in the past. There is some presumptive evidence that *A. subpictus* may transmit malaria in Papua, and *A. annulipes* (or *A. amictus*) in north Queensland.

SMITH (R. O. A.). **The Breeding of Sandflies in Nature and in the Laboratory.**—*Trans. 7th Cong. Far East. Ass. Trop. Med. 1927*, iii, pp. 182–185. Calcutta [1930].

The conditions under which sandflies (*Phlebotomus*) breed in nature are discussed from the literature, the main requirements being the presence of a certain degree of moisture, absence of sunlight, suitable conditions of temperature, and the presence of any form of decomposing nitrogenous matter on which the larvae can feed. The cycle from egg to adult takes about 30 days in summer and 2–3 months in winter. The methods described for the collection and examination of material for detecting the presence of larvae and for breeding *P. papatasii*, Scop., have already been noticed [*R.A.E.*, B, xiv, 147]. Another method, by which *P. argentipes*, Ann. & Brun., *P. papatasii*, *P. minutus*, Rond., and *P. squamipleuris*, Newst., have been successfully bred in the laboratory, is also described. Single females are confined in a suitable receptacle from which the eggs are collected, those of each fly being bred separately. Females of *P. argentipes* bred in the laboratory will oviposit readily in a test tube, but a large lamp glass arranged over

damp filter paper or plaster of Paris has been found most efficient for those taken in nature. The ova are washed or brushed into a small earthenware pot lined with a thin layer of plaster of Paris ; food is placed in the spaces between the eggs, and the pot, covered with a piece of muslin to protect it from other flies as well as from ants and mites, is placed in a tray containing wet sand or damp cotton wool. The pot is then incubated at a temperature found most suitable for the sandflies under experiment, the species mentioned having been successfully bred at 28° C. [82·4° F.]. Pots containing eggs should feel damp to the touch but there should be no free water. The young larvae require less moisture, and as they grow the amount of water necessary decreases, practically none being required during pupation. The most convenient food for the larvae is crushed faeces of rabbits or goats, mixed with a small quantity of dried blood. The amount of food and moisture should be regulated daily. Pots containing pupae should be placed in separate cages from which the flies may be taken as required. Although the best results were secured by this method, the larvae may also be hatched out *in situ* by placing the filter paper or plaster of Paris block on which the eggs are laid in a suitable vessel and keeping it damp.

Both eggs and larvae are subject to attack by Gamasid mites, and the larvae are also destroyed by ants or are liable to be starved out by other rapidly developing larvae such as Mycetophelids. A Nematode found infesting *P. argentipes* causes the death of the sandfly during either the first or second oviposition. The larvae hatch in the coelomic cavity of the sandfly and infest the ovaries, possibly blocking the oviduct. Such flies can generally be recognised and should be discarded to prevent the spread of infestation to the next generation.

In the discussion that followed, it was stated that larvae of *P. argentipes* were found in nature in situations of a different character from those in which *P. papatasii* breeds, occurring almost invariably inside houses in cracks in the cement floors or in rat-holes. In the laboratory, *P. argentipes* does not breed well by the method found most successful for *P. papatasii*.

KOBAYASHI (H.). **Study on the seasonal Prevalence of House Flies in Chosen (Korea).**—*Trans. 7th Cong. Far East. Ass. Trop. Med. 1927*, iii, pp. 186–195, 10 charts. Calcutta [1930].

An account is given of laboratory experiments in artificial feeding of larvae and adults of flies to determine their capacity for reproduction. About 10 flies were put into a broad test tube, 230 by 35 mm., containing a piece of biscuit on to which a few drops of 5 per cent. peptone water were poured daily. The amount of fluid must be regulated according to the relative humidity in the laboratory, too much being harmful to the flies, whereas they die of thirst if the humidity is insufficient. The tube is plugged loosely with cotton and laid horizontally on the table. The biscuit should be renewed if it becomes mouldy, and the whole apparatus must be kept clean. The date and frequency of mating, oviposition and death of the flies were noted daily. When oviposition was observed, the flies were transferred to another tube, and when the larvae hatched, the residue of some boiled beans was placed in the tube. This food proved satisfactory for the larvae of *Musca domestica*, L., *Muscina stabulans*, Fall., *Fannia canicularis*, L., and *Stomoxys calcitrans*, L. For carnivorous flies, such as *Sarcophaga*

Mg., it was necessary to add animal matter. Mature larvae were transferred to another tube containing a mass of cotton to pupate.

The results secured with *Musca domestica* showed the length of the life-cycle to vary between 1 month in summer and 2–5 in winter. There is a minimum pre-oviposition period of 3 days, and oviposition occurs repeatedly at varying intervals according to temperature, humidity and quality of food. The temperature must be above 15° C. [59° F.], 30° C. [86° F.] being very favourable. Oviposition is frequent during hot, dry periods and infrequent during periods of lower temperature and higher humidity. Similar results were secured with *C. erythrocephala* and *S. irrequieta*. With *Muscina stabulans*, *F. canicularis* and *L. sericata* mating occurred only rarely in the tubes, oviposition was retarded and few fertilised eggs were obtained.

The results obtained in collections of flies from houses were similar, so far as *M. domestica* was concerned, to those noticed elsewhere [*R.A.E.*, B, xviii, 44]. *Fannia* spp. and *Muscina* increase later and decrease sooner than *Musca*. *Sarcophaga* spp. and *Lucilia* spp. are prevalent from June to August and usually disappear about the middle of October. *Musca domestica*, *Muscina stabulans*, *C. erythrocephala*, *C. lata*, Coq., *F. canicularis* and *F. scalaris*, F., overwinter in the adult stage. *Sarcophaga irrequieta*, *Stomoxys calcitrans*, and some individuals of *F. canicularis* hibernate in the pupal stage; and a prolongation of the larval and pupal stages of *L. sericata*, which does not hibernate, occurs in the winter season, the duration of prolonged development sometimes being 4 months. The results of meteorological studies are also shown and indicate, when compared with the seasonal prevalence of the flies, that hot, dry weather favours oviposition and longevity, particularly in the case of *M. domestica*. The hot, dry air in the rooms of houses heated in the Korean style in winter favours the overwintering of adult flies and results in prevalence in early spring.

Sundar Rao (S.). **Filarial Infection and Diseases due to** *Filaria bancrofti*.—*Trans. 7th Cong. Far East. Ass. Trop. Med. 1927*, iii, pp. 299–304. Calcutta [1930].

This account of investigations carried out in relation to the distribution of filariasis in India and on the diseases due to *Filaria bancrofti* includes a report of studies in natural and experimental mosquito infection. Dissections of mosquitos taken in nature, showed 10 per cent. to be infected in Cuttack and 2·5 per cent. each in Khargpur and Calcutta. In Cuttack, the infection rate of *Culex fatigans*, Wied., was 3 per cent. in July, 7·5 per cent. in August, September and October, and 12·5 per cent. in November and December, showing that natural infection is greatest during the winter months. An examination of laboratory-bred *C. fatigans* after experimental feeds on persons having microfilariae in their blood during the same season at Cuttack showed the following percentage of infection: May and June, 13; August, September and October, 34; December and January, 78 per cent. The period of maximum infection thus corresponds to that seen in nature. The time taken for the embryos to develop in the body of the host showed a close relation to temperature, since in August, with an average maximum of 93° F., they reached the proboscis in 14 days, whereas in December, with an average maximum of 80° F., they required 22. The minimum temperatures were 86 and 55° F. in August and December respectively, and the humidity was 90 and 85 per cent.

WEBSTER (W. J.) & CHITRE (G. D.). **Observations on Rat-fleas and the Transmission of Plague. Part I.**—*Ind. J. Med. Res.*, xvii, no.3, pp. 699–709, 4 refs. Calcutta, January 1930.

An account is given of experiments carried out in Bombay during 1928–29 on the comparative importance of *Xenopsylla cheopis*, Roths., *X. astia*, Roths., and *X. brasiliensis*, Baker, in the transmission of plague. Fleas were fed in the laboratory on mice fed on sterilised food, and laid their eggs chiefly in sterilised warehouse sweepings (consisting chiefly of rat dung and vegetable refuse) spread on the floor of the cage. After ten days the litter was collected and stored in a glass jar with an aluminium cover. Young fleas were found in the jar after about two weeks and continued to emerge for a further two or three weeks. When required for experiment, the fleas were captured singly in test tubes and the sex distinguished by the dorsal groove on the head of the male. By preparing a family of each species once a fortnight, a constant supply of the required species of fleas in moderate numbers was available. In most of these experiments, 36 fleas (six males and six females of each species) were introduced into a cage containing an infected rat. If the rat died of plague, the fleas were collected and again identified. Subsequently each of the six groups was fed on a separate uninfected rat, each flea being applied in turn. If the flea had not attempted to feed at the end of two minutes, it was removed. The fleas were usually applied on three successive days, each group to the same rat as before. The rats were subsequently kept in cages until they died or for three weeks, when they were killed. In this series of experiments a total of 529 fleas was originally fed, of which 438 were recovered. These were offered a total of 1,206 feeds, of which 767 were accepted. Two rats died of acute plague; in both cases the fleas used had been males of *X. brasiliensis*. One rat on which females of *X. cheopis* had been fed survived for three weeks, but showed well-marked signs of resolved plague on *post mortem* examination. No transmission occurred with *X. astia*. In view of the fact that *X. brasiliensis* forms a considerable proportion of the rat-flea population of Southern India, the successful transmission with this species is of interest. In the case of the three successful transmissions, none of the fleas had been recognised as blocked, all appeared to draw blood, and none defaecated during the feed. In several of the negative experiments defaecation was observed and temporary blocking was also noted. A large proportion of the fleas of the three species, after leaving a septicaemic animal and feeding in the interval, still harboured plague bacilli after several days. Examination of smears of the stomach contents demonstrated only a certain number of infected fleas, whereas the growing of cultures showed a much larger number.

A method of investigation was designed to demonstrate to what extent *X. cheopis* and *X. astia*, respectively, can carry on a plague epizootic among highly susceptible rats under optimum conditions in Bombay. Two circular flea-proof pits six feet across to represent warehouses were constructed with walls 3 ft. high and 1 ft. thick in a rat-proof room with a flea-proof floor. The inner surface and tops of the walls of the pits were finished with smooth cement. The tops of the walls were smeared with a resinous compound to prevent the entry or exit of fleas, and the resin was prevented from trickling down inside by a rim of plasticine. Sterilised warehouse sweepings and straw were placed on the floor of the pits and a lidless box with the ends removed

was inverted to give cover for the rats. The food of the rats was sterilised, and the rats themselves were freed from ectoparasites. The fleas used were bred in the laboratory. Twelve healthy rats were placed in each pit and in the course of the following month, 50 males and 50 females of *X. cheopis* were placed in one pit and the same numbers of *X. astia* in the other. Rats inoculated with plague were subsequently introduced into each pit. Dead rats were removed once a day and replaced by healthy ones. The results, which are shown in tables, prove that given highly susceptible animals, a virulent strain of plague and many fleas, both *X. astia* and *X. cheopis* are successful transmitters of plague. Experiments in which fed fleas of both species from the pits were placed in batches of males and females on rats in transmission cages indicated that the females were more capable transmitters than the males. It was found that the three species of fleas can live for many days on a diet of human blood alone, with the exception of males of *X. astia*, which did not live more than a few days although many fed readily.

MUKERJI (S.). **On an improved Method of dissecting Sand Flies for Parasitological Observations.**—*Ind. J. Med. Res.*, xvii, no. 3, pp. 755–757, 2 refs. Calcutta, January 1930.

While carrying out dissections of infected and non-infected individuals of *Phlebotomus argentipes*, Ann. & Brun., the author discovered a simple and effective technique. After being soaked for about 20 minutes in sterile normal saline solution, the specimen to be dissected is placed on its side on a clean slide with a drop of saline solution evenly spread. The wings, legs, etc., are then cut off, together with the two terminal segments of the abdomen. The thoracic region is held at the coxal ends of the legs and the border of the head behind the eyes gently teased until the head is separated from the rest of the body, when the proventriculus, the paired globular salivary glands and a portion of the oesophageal diverticulum become visible. The excess fluid is soaked up with blotting paper, and the head and dissected portion of the gut are held sufficiently firmly by surface tension to eliminate the necessity of using a second needle. By holding the lateral edge of the thorax with a looped needle and using a series of short steady pulls in the direction of the abdomen, the entire alimentary canal is freed, and after slight manipulations to get the appendages into position, the organ may be refloated in a drop of normal saline and examined for parasites.

SUNDAR RAO (S.) & IYENGAR (M. O. T.). **Studies on the Influence of Season on the Development of** *Filaria bancrofti* **in** *Culex fatigans*.—*Ind. J. Med. Res.*, xvii, no. 3, pp. 759–767, 2 pls., 1 fig., 4 refs. Calcutta, January 1930.

In experiments on the infection of *Culex fatigans*, Wied., with embryos of *Filaria bancrofti* by feeding the mosquitos on cases of filariasis, it was found that the percentage of infection (the percentage of mosquitos found to contain embryos) and the intensity of infestation (the number of embryos found in a mosquito) varied at different times of the year, and that the time taken for the development of the embryos from the sheathed microfilaria stage to the final active mature stage in the

proboscis of the mosquito also varied in different seasons. An investigation was therefore undertaken over a whole year to study the development of the embryos during the different seasons. Freshly emerged individuals of *C. fatigans* bred in the laboratory were fed between 11 p.m. and midnight on cases showing about 20 microfilariae per 20 cu. mm. of the peripheral blood at night. Only those mosquitos that took a full blood meal were retained for experiment. These were subsequently fed on raisins and water only. The infectivity and development of the embryos were studied both by dissections and by cutting serial sections of the mosquito. The latter method was found to be very reliable, as every part of the tissue can be examined.

In Calcutta, where the experiments were carried out, there are roughly three distinct seasons. During the monsoon or wet season (July to September), when the temperature is usually between 79 and 89° F., and the humidity is always above 80 per cent., both the rate of infection and the intensity of infestation were high. Usually more than 15–20 embryos were found in each mosquito. The time taken for their development was low, *viz.*, 11 days in July and 10 in August and September. During October, when the temperature is slightly higher and the humidity somewhat lower, the time taken for development was still only 10 days, but in November, when the temperature is much lower and the minimum humidity falls to 50 per cent., the embryos took 15 days to mature. During the cold season (December to February), the mortality of the mosquitos was high even under laboratory conditions, the infection rate was low, and the number of embryos developing in each mosquito was small, 1 to 4 being the maximum found during this season. The embryos took 18–20 days to mature. In February, only a few of the large number of mosquitos fed became infected, and in the infected individuals the number of embryos was only about one or two. During March, the temperature is higher, but the humidity falls as low as 30 per cent. There was a high mortality among the mosquitos, the infection rate was low and the time taken for the embryos to mature was 16 days. During the hot season (April to June), the mortality was still high, but the infection rate was also fairly high, *viz.*, 50–60 per cent. The embryos developed in 11–12 days, but the number of embryos was small.

Experiments were carried out in February 1928 to determine whether it was possible to obtain a heavier infection of the mosquitos or a more rapid development of the embryos during adverse seasons by controlling conditions of temperature and humidity. A batch of mosquitos was fed on the same filaria case at the same time, one half being kept at room temperatures and the other under conditions similar to those prevailing during the wet season. Most of the mosquitos kept at room temperature were negative, only a single individual having one or two immature embryos, whereas those kept in the wet incubator under controlled conditions all contained 5–10 parasites, many of which had matured. The embryos took 12 days to mature. The only differences between the two batches were the conditions of temperature and humidity. Temperatures below 75° F. and over 92° F. seem to have an inhibitory effect on the development of the embryos, the most rapid development occurring between 85 and 90° F. Humidity exerts an even greater influence, the rate of infection and intensity of infestation being high with high humidity and low with low humidity.

The authors discuss the opinions expressed by workers on the development of malarial parasites in Anophelines and consider that their own

results support the view that high humidity affects the parasite not only by prolonging the life of the mosquito sufficiently to allow of its reaching maturity, but also by facilitating directly the development of the parasite; for during the hot season, with a high temperature but very low humidity, the degree of infestation and the percentage of infection were very low even when the mosquitos were kept alive sufficiently long to enable the parasites to complete their development.

IYENGAR (M. O. T.). **Larvae of Oriental Tree-hole breeding Anophelines.**—*Ind. J. Med. Res.*, xvii, no. 3, pp. 769–776, 2 pls., 12 refs. Calcutta, January 1930.

Five oriental tree-hole breeding Anophelines have been recorded from small, isolated and often widely separated areas. *Anopheles culiciformis*, Cogill, has been taken only in the hills of the west coast of India. *A. barianensis*, James, occurs in the Punjab and Kashmir at elevations of over 6,000 ft. *A. annandalei*, Prashad, is found in the eastern Himalayas, Khasi Hills and Ceylon. *A. asiaticus*, Leic., which breeds in bamboo holes, is known only from the Malay Peninsula. *A. annandalei* var. *djajasanensis*, Brug, occurs in Java at elevations of more than 4,000 ft. These mosquitos all breed in tree or bamboo holes, and their distribution is further restricted by the fact that they are forest species that are usually found in hilly regions and are seldom observed in the sub-montane zone.

A key is given to the larvae, which are also described. The characters common to all of them are enumerated, and it is shown that these are also found in tree-hole breeding Anophelines in other parts of the world. The author points out that these species may be divided into two groups in which the adults are quite distinct although the larvae are difficult to distinguish, and he suggests that the resemblance in the larval stage is the result of convergence owing to similarity of habitat rather than of any close affinity. He does not agree with Puri [*R.A.E.*, B, xviii, 75], who differentiates the specimens of *A. annandalei* collected from the eastern Himalayas and the Khasi Hills into the typical form and a new variety (var. *interruptus*), and considers *A. annandalei* var. *djajasanensis* a synonym of the former.

SHORTT (H. E.), CRAIGHEAD (A. C.), SMITH (R. O. A.) & SWAMINATH (C. S.). *Phlebotomus argentipes* **caught in Nature infected with** *Leishmania donovani*.—*Ind. J. Med. Res.*, xvii, no. 3, pp. 913–914, 1 ref. Calcutta, January 1930.

Out of 226 individuals of *Phlebotomus argentipes*, Ann. & Brun., collected in Assam during the period from 28th March to 30th August 1928 in the houses of kala-azar cases, seven proved to be infected with *Leishmania donovani* [*cf. R.A.E.*, B, xv, 17].

SHORTT (H. E.), CRAIGHEAD (A. C.), SMITH (R. O. A.) & SWAMINATH (C. S.). **Third Series of Transmission Experiments in Kala-azar with** *Phlebotomus argentipes*.—*Ind. J. Med. Res.*, xvii, no. 3, pp. 921–927, 1 ref. Calcutta, January 1930.

A further series of experiments is described, in which seven volunteers were submitted to the bites of *Phlebotomus argentipes*, Ann. & Brun.,

infected with kala-azar on an even more intensive scale than that previously achieved [*R.A.E.*, B, xvii, 29]. Eighteen months after the initiation of the experiments none of the volunteers showed any sign of infection, but a greater period of time must elapse before the results can be said to be definitely negative. Healthy mice used for feeding infected sandflies on days when they were not being fed on man did not contract the disease although the intensity of feeding was very great. As it was considered possible that the blood of animals other than man, from whom the parasite was originally obtained, might interfere with its infectivity and thus be responsible for the failure to produce infection, a number of sandflies were fed exclusively on human beings (kala-azar cases) up to their fourth feed. Their fifth and subsequent feeds were on experimental mice. This method also ensured that the infection with flagellates was a comparatively old one, and that sufficient time had elapsed for the production of special infective forms if any such exist. The results of this experiment were also negative. The sandflies used in all the experiments were exclusively those having their third or subsequent feed. As the intensity of exposure to infection was greatly in excess of any that could occur under the most favourable natural conditions in Assam, the failure to obtain infection when fresh cases were diagnosed daily from the surrounding town and countryside is difficult to explain if the theory of transmission by *Phlebotomus* is to be maintained.

PURI (I. M.). **A Note on two Species of Indian Anopheline Mosquitoes — *A. insulaeflorum* Swellengrebel and *A. aitkenii* James, with its Variety *bengalensis* nov. var.**—*Ind. J. Med. Res.*, xvii, no. 3, pp. 953–956, 6 refs. Calcutta, January 1930.

Of a number of larval forms of *Anopheles aitkeni*, James, described by Swellengrebel from the Dutch East Indies [*R.A.E.*, B, vii, 183], three appear to occur in India. The larvae with simple inner anterior clypeal hairs that have been found in Bengal and Bombay agree in all essentials with those of *A. insulaeflorum* described by Swellengrebel as a variety of *A. aitkeni* [viii, 136]. It has been pointed out by Christophers [xiii, 109] that the larval characters of this variety are sufficiently different to denote a distinct species, and a detailed examination of the adults reared from the larvae has now revealed certain well-marked differences in the genital armature of the males. In India the larvae with the inner anterior clypeal hairs split in two a little beyond the base have so far been found only in the south, whence *A. aitkeni* was originally described, and belong to the typical form of this species. Larvae with these hairs split into 3–5 branches in the distal half have only been collected in the north-east, and as males bred from them show certain differences in the detailed structure of their genital armature, this form is considered a distinct variety, *A. aitkeni* var. *bengalensis* n. The adults and larvae of the three mosquitos are briefly described with notes on their distribution.

DOVER (C.). **An improved Citronella Mosquito Deterrent.**—*Ind. J. Med. Res.*, xvii, no. 3, p. 961, 1 ref. Calcutta, January 1930.

A cream made by melting 2 oz. of white petroleum jelly and stirring ½ oz. citronella oil, ¼ oz. spirits of camphor and ¼ oz. cedar-wood oil,

has been used with great success as a mosquito deterrent. Unlike pure citronella oil, it is not irritating to the skin. One application usually lasts for a night, and only a small quantity need be used.

MAYNE (B.). **Tests on the Effects of Coumarin on the Life of the Mosquito and the Malaria Parasite.**—*Ind. J. Med. Res.*, xvii, no. 3, pp. 963–969, 2 refs. Calcutta, January 1930.

It has been claimed that the cultivation of clover and other leguminous plants renders certain areas free from malaria [*R.A.E.*, B, xvi, 26], though the means by which the active chemical substance, coumarin, affects the dissemination of the disease has not been intimated. Experiments are described in which the effect of synthetic coumarin on the mosquito and on the malarial parasites was investigated. The results indicated that solutions of coumarin at strengths varying from 1 : 2,250 to 1 : 500,000 did not exert any considerable deleterious influence on adults of *Anopheles* spp. and *Culex fatigans*, Wied.; in one case, mosquitos exposed to a strength of 1 : 3,500 lived for 20 days, whereas the maximum length of life in the controls was 19 days. Strengths of from 1 : 1,000 to 1 : 2,000, however, were toxic in from 4 hours to 4 days, death being apparently due to asphyxiation and paralysis rather than to the ingestion of the liquid. When individuals of *C. fatigans* fed on birds harbouring avian plasmodia were exposed to coumarin at strengths varying from 1 : 1,000 to 1 : 500,000, little or no lethal effect was observed on the parasites. Living sporozoites removed from the glands of *C. fatigans* and mixed with coumarin solutions of from 1 : 1,000 to 1 : 12,500 were killed, but weaker solutions had no apparent effect. The ingestion of the liquid by the mosquito did not seem to affect gametogenesis or the development of zygotes within the mosquito. The author therefore considers that coumarin taken with the liquid extracted from clover blossom would have no deterrent action on malarial parasites undergoing development in the mosquito.

SMORODINZEW (I. A.) & ADOWA (A. N.). **Le rôle du calcium dans l'écologie des larves d'***Anopheles*.—*Bull. Soc. Path. exot.*, xxiii, no. 1, pp. 34–38. Paris, 1930.

Following up previous experiments on the physico-chemical factors influencing the occurrence of *Anopheles maculipennis*, Mg., in peat-bogs in Russia [*R.A.E.*, B, xvii, 65, etc.], the calcium factor in particular has been studied, previous indications being that the percentage of adults was the same from waters either rich or poor in calcium, but that the preference of ovipositing females was definitely for the waters rich in calcium. Artificial reservoirs were all filled with natural sedgy (*Carex*) waters, and with the exception of one kept as a control, the calcium content of each was modified, being either lowered by the addition of sodium oxalate ($C_2O_4Na_2$) or raised by the addition of calcium hydrate, $Ca(OH)_2$. The addition of sodium oxalate had practically no effect on the pH of the water; this is of great importance in view of the primary value of the hydrogen-ion concentration in the ecology of Anopheline larvae. By introducing twice the amount of sodium oxalate that is theoretically necessary for the total elimination of the metal, a solution was obtained that with regard to the calcium factor was similar to sphagnum water but showed a pH proper to sedge

water. Biological observations had shown that Anopheline larvae do not live and develop in such decalcified water quite so well as in that in which the proportion of calcium is sufficient. In obtaining a sedge water rich in calcium, a slight alkalinity was produced, but the pH remained practically constant, at about 7·5, rising to 8·9 during the addition of the calcium hydrate but dropping rapidly again to normal. Biological observations showed considerable delay in development of larvae in this water ; this is considered to be due, not to the raising of the pH to 8·9, but to excess of calcium ions. It is evident from these experiments that in sedge waters with a constant pH and all other conditions equal, an increase of 3 or 4 times the amount of calcium above the normal or a decrease of $3\frac{1}{2}$ times the amount has no apparent effect on the biology of *A. maculipennis*.

Smorodinzew (I. A.) & Adowa (A. N.). **Sur le rôle de la réaction du milieu dans l'écologie des larves d'***Anopheles maculipennis*.—*Bull. Soc. Path. exot.*, xxiii, no 1, pp. 38–43. Paris, 1930.

Previous studies [*cf. R.A.E.*, B, xviii, 10, etc.] have shown that hydrogen-ion concentration is of great importance in relation to larvae of *Anopheles maculipennis*, Mg., and that from the point of view of their microflora and fauna and of their degree of infestation, peat-bogs of sedge or sphagnum are from an ecological point of view at opposite poles. Because sedge waters, which are favourable to the larvae, are invariably alkaline, and sphagnum waters, where larvae are not found, are acid, the authors decided to make a cross-experiment, leaving all other conditions so far as possible the same, but modifying the sedge water to an acid reaction and the sphagnum water to an alkaline. The technique of carrying out these experiments in the insectary is explained, and the results are indicated in a graph. The zone favourable to development of larvae shows a pH varying between 5 and 10. Natural sedge water with pH 7·5 corresponds to the optimum conditions for larval life and development. The artificial acidulation or alkalinisation of sedge peat-bog water causes the death of the larvae. The curve corresponding to natural sphagnum water never enters the favourable zone, and larvae are never found in it in nature. It is sufficient, however, to render this water alkaline, and larvae can then live in it. When the pH of sphagnum waters decreases owing to natural reactions of the peat, the larvae die. Under natural conditions, production of a more alkaline condition occurs when peat is extracted by hydraulic methods from a bog, owing to its having been rendered more liquid by the addition of large quantities of fresh water with an alkaline reaction. During this process, the pH of the sphagnum water is artificially raised above 5, and in such cases larvae of *A. maculipennis* occur. These facts point definitely to the danger of the occurrence of malaria in regions where sphagnum peat is extracted by such methods.

Trensz (F.). **Recherches sur l'index maxillaire de** *Anopheles maculipennis*. **(Note préliminaire.)**—*Bull. Soc. Path. exot.*, xxiii, no. 1, pp. 43–47. Paris, 1930.

In connection with Roubaud's theory regarding the indication by means of the maxillary index of the existence of races of *Anopheles maculipennis*, Mg., that prefer to feed on animals rather than man

[*R.A.E.*, B, xvi, 210, etc.], the author has examined the index of over 4,000 Anophelines from Algeria, Italy and France. Details are given of the results in each group, and the conclusion is reached that they give no support to any connection between the maxillary index and either feeding habits or the geographical distribution of malaria. It is contended that Roubaud examined far too few Anophelines to draw any definite conclusions, and that the local biological variations on which he bases his assumptions are so minute as to come within the limits of chance differences, while the differences in the maxillary index between one country and another cannot be explained by zootropism or by the difference of size between the insects, as in Martini's hypothesis. With regard to the theory of keen competition between Anophelines, shown by the small proportion of engorged females, the raising of the maxillary index and differences of dentition between gorged and non-gorged females, this also has broken down under the numbers examined. No single fact was found to confirm the theory of zootropism.

ROUBAUD (E.). **Quelques remarques à propos de l'interprétation théorique des index maxillaires.**—*Bull. Soc. Path. exot.*, xxiii, no. 1, pp. 47–53. Paris, 1930.

Answering Trensz' criticism regarding his theory of the interpretation of the maxillary index in *Anopheles maculipennis*, Mg. [see preceding paper], the author considers that zootropism in this species, with its important bearing on malarial incidence, is a proved fact that requires no support from any consideration of maxillary armature. He repeats his interpretations [*R.A.E.*, B, xvi, 210], and remarks that his statistics were not intended as proofs, but were only set out with the idea of making clear his findings. He admits that examinations of many thousands of Anophelines would be an advantage, although he contends that even less than one hundred can give useful indications, and that chance does not enter into the important differences that they exhibit. All evidence at present points to the fact that in all zones where *A. maculipennis* occurs, the most malarial regions are those in which the mosquito lives essentially on man and not on cattle, and that in such regions (Corsica, Algeria, Syria, etc.) it exhibits the lowest known maxillary power. In all the regions of Europe where the mosquito lives essentially on animals other than man, malaria, if it occurs at all, is far less general and severe, and the average maxillary power of the mosquito is always higher. In certain regions, such as the coast of Holland, where zootropism occurs and where the Anopheline fauna is excessively dense, the maxillary armature is exceptionally developed and malaria still persists. These facts are considered as more than coincidences in favour of the theory.

Besides certain differences in the technique of their examinations, the author points out that Trensz has not taken into consideration, in stating the differences in the maxillary armature of Algerian Anophelines, whether the mosquitos came from regions in which domestic animals were kept in stables or not. He is convinced that in Europe the maxillary development related to zootropism in *A. maculipennis* evolved but slowly, as a result of a number of complex factors and as a consequence of better stabling conditions in each region. A mere increase in the number of animals would have no bearing on the factors favouring zootropism. He suggests that if Trensz was unable to observe differences in the type of dentition connected with different hosts, it

may have been because the conditions or the season did not reveal these, and considers that it is far better to choose some typical localities and study the fauna there year by year than to rely upon disconnected mass examinations. His present hypothesis is based upon years of study, which is still continuing, and it is only by the revision of results after long and precise experiments and observations that the truth can be arrived at.

D'Anfreville de la Salle (L.). **Un moyen de lutter contre le paludisme au Maroc.** *Bull. Soc. Path. exot.*, xxiii, no. 1, pp. 53-58. Paris, 1930.

The author points out the advantages of using fish that feed on mosquito larvae as an auxiliary measure in anti malarial work in Morocco. He has had practical experience of the success of *Gambusia* and an indigenous Cyprinid in this connection; the former has now become established in the country.

Legendre (F. M. A.). **Rapport du service antipaludique à Madagascar, pour l'année 1928.** *Ann. Méd. Pharm. colon.*, xxvii, no. 4, pp. 562-609. Paris, 1929. Abridged in *Bull. Soc. Path. exot.*, xxii, no. 10, pp. 1016-1028; & xxiii, no. 1, pp. 122-132. Paris, 1929 & 1930.

The Anophelines found in Madagascar are *Anopheles gambiae*, Giles (*costalis*, Theo.), *A. mauritianus*, Grp., *A. squamosus*, Theo., and *A. pharoensis*, Theo., the first named being the most numerous and the most important vector of malaria. As an anti-mosquito measure, rice cultivation was forbidden in a certain area, but it was eventually found necessary also to drain the rice-fields, which had become worse breeding-places than before. Paris green is used as the cheapest efficient larvicide, and *Gambusia* has been introduced and is being established with much success. Goldfish had previously been tried, but did not give good results.

Manalang (C.). **Notes on *Phlebotomus nicnic* Banks. A new Species of the Genus *Phlebotomus* Rondani.** *Philipp. J. Sci.*, xli, no. 2, pp. 169–173, 1 pl., 6 refs.; pp. 175–179, 1 pl., 3 refs. Manila, February 1930.

Both sexes of *Phlebotomus nicnic*, Banks [*R.A.E.*, B, vii, 193] and *P. philippinensis*, sp. n., are described from the Philippines, and the characters distinguishing them from one another and from allied Asiatic species are discussed. *P. nicnic* is a recumbent-haired species, *P. philippinensis* an erect-haired one. Both occur in the same localities.

Simmons (J. S.), St. John (J. H.) & Reynolds (F. H. K.). **Transmission of Dengue Fever by *Aëdes albopictus* Skuse.** *Philipp. J. Sci.*, xli, no. 2, pp. 215-231, 1 pl., 1 fig., 16 refs. Manila, February 1930. Abridged in *Amer. J. Trop. Med.*, x, no. 1, pp. 17–21, 9 refs. Baltimore, Md., January 1930.

Aëdes albopictus, Skuse, is a common mosquito in the Philippines, and recent observations in Manila showed that its larvae often occur in the

same breeding-places as those of *A. argenteus*, Poir. (*aegypti*, auct.), and also that the proportion of *A. albopictus* to *A. argenteus* increased in June and July, when dengue was very prevalent. Details are given of seven experiments in which from 1 to 22 laboratory-bred females of *A. albopictus* were allowed to feed on volunteers, under conditions that precluded other sources of infection, 13–22 days after feeding on a dengue patient. Infection resulted in every case, the onset of the disease occurring in 5–7 days.

A. albopictus is prevalent in many parts of the Orient where dengue is endemic, and it must be considered an important vector of the disease. Since both *A. argenteus* and *A. albopictus* transmit dengue, it seems likely that other species may also prove to be vectors.

Sr. John (J. H.), Simmons (J. S.) & Reynolds (F. H. K.). **Transmission of the Virus of Dengue Fever from Mosquito to Mosquito.**—*Philipp. J. Sci.*, xli, no. 3, pp. 381–385, 1 pl. Manila, March 1930. Abridged in *Amer. J. Trop. Med.*, x, no. 1, pp. 23–24. Baltimore, Md., January 1930.

By means of a special technique, which is described, it has been possible to infect normal individuals of *Aëdes argenteus*, Poir. (*aegypti*, auct.) by feeding them on a mixture of citrated human blood and macerated dengue-infected mosquitos through the skin of a guineapig. The mosquitos fed on this mixture later produced dengue fever in two volunteers. This method should prove of value in the study of other virus diseases transmitted by insects.

Philip (C. B.). **Studies on Transmission of experimental Yellow Fever by Mosquitoes other than** *Aëdes*.—*Amer. J. Trop. Med.*, x, no. 1, pp. 1–16, 8 refs. Baltimore, Md., January 1930.

In view of previous successful experiments with various mosquitos [*R.A.E.*, B, xvi, 235; xvii, 213], tests were conducted in Nigeria to determine whether *Taeniorhynchus* (*Mansonioides*) *africanus*, Theo., and *Anopheles gambiae*, Giles (*costalis*, Theo.) are able to transmit yellow fever from infected to healthy monkeys (*Macacus rhesus*). Both these species are important, house-frequenting mosquitos in West Africa, and they readily attack man. In March 1929, 23 females of *T. africanus*, of which 22 were freshly gorged, were collected from four sleeping rooms of native servants. This mosquito breeds in ponds and even in streams that become clogged during low water with abundant growths of water lettuce (*Pistia stratiotes*), to which the immature stages attach themselves for purposes of respiration.

The method of handling the mosquitos and the laboratory technique are described. In experiments with *T. africanus*, yellow fever was transmitted to 10 out of 23 monkeys, 8 of which died, both by bites of the mosquitos and by injecting an emulsion of their ground bodies. One insect was sufficient to cause a typical fatal infection. Similar experiments with *A. gambiae* gave negative results after a period equivalent to that required by *Aëdes argenteus*, Poir. (*aegypti*, auct.) to become infective by bite, though infection was produced by injection up to four days after the mosquitos had fed on the infected monkey. Attempts to determine the incubation period of the virus in *T. africanus* failed, because of an

apparently low percentage of infection among the insects, the first transmission occurring at 16 days. *Aëdes argenteus* proved positive in 8 days twice and in 9 days once from the time of the original feeding.

JAMES (S. P.). **Report on a Visit to Kenya and Uganda to advise on Antimalarial Measures.**—8vo, 48 pp. London, The Crown Agents for the Colonies, 1929. Price, 1*s*.

This report is the result of a visit to Kenya and Uganda from 25th March to 19th June 1929.

The creation of a special organisation for investigating the malaria problems of Kenya, to be known as the "Malaria Survey of Kenya," is recommended, and the appointment, training and duties of the staff of this proposed research unit are outlined; a very important part of the work should be to make regular and detailed observations at various field stations on the prevalence of malaria and the prevalence and infection rate of Anophelines.

Measures for the control of malaria in towns and rural areas, and among the various classes of the community, are dealt with in some detail. The author endorses the policy of drainage, etc., for the control of Anophelines in the towns, but he considers that such measures alone, especially in Nairobi, are not adequate to ensure success, and that they should be supplemented by an attempt to deal with the disease itself. He believes that malaria is essentially a household disease in the towns, and that after the completion of the drainage works, it will be most successfully combated by householders themselves acting on the advice of a malaria officer. The native domestic servants, who are usually housed on the premises of their employers, are the chief source of infection. Any scheme for the control of malaria in the towns should be supported by strict anti-mosquito legislation. The large native staffs employed on the railways in various towns are a constant source of infection for the local Anophelines, and consequently for Europeans and Asiatics. Attention should be paid to the screening of railway hotels and houses and station waiting-rooms.

The prevention of malaria on farms in settled areas is essentially a household matter for which the individual settler, acting on medical advice, must be responsible. Detailed recommendations are made regarding the site, planning and type of construction of the homestead and the treatment of neighbouring streams. As in the towns, it is the native servants and their families that are usually the original source of malarial infection; their huts should never be less than 200 yards from the settler's house. New settlers, who have to live in tents or thatched huts for a time before they can build a permanent and properly screened house, should be required to use mosquito nets and mosquito boots and to take other precautions advised locally.

The severity with which malaria affects Indians in Kenya, many of whom must have passed through repeated attacks in childhood before leaving their own country, exemplifies the observation that immunity acquired in one country does not necessarily afford protection against what appear to be the same parasites in another. The first need with regard to malaria control amongst Asiatics, most of whom live in the larger towns, is an improvement in their conditions of life.

In the native reserves, malaria cannot satisfactorily be dealt with apart from other medical and public health problems, or without the aid of an educational campaign. Before success for such a campaign

can be expected, the economic status of the people must be raised by the improvement of native agriculture, which must be based on irrigation schemes.

The section of the report dealing with Uganda is mainly concerned with Kampala. In this town, blood examinations showed that *Plasmodium vivax*, *P. falciparum* and *P. malariae* all occur, *P. vivax* being the commonest. Anophelines collected in huts during May were *Anopheles gambiae*, Giles (*costalis*, Theo.) (73 per cent.), *A. funestus*, Giles (22 per cent.), and *A. theileri*, Edw. (4 per cent.). Zygote infections were found in the stomachs of 37 out of 355 individuals of *A. gambiae* and 16 out of 129 of *A. funestus*, and sporozoite infections in the glands of 7 out of 119 of *A. gambiae* and 1 out of 36 of *A. funestus*.

Watson (Sir M.). **Antimalarial Measures.**—*Brit. Med. J.*, no. 3605, pp. 259–260. London, 8th February 1930.

In connection with the preceding paper, the author states that his experience of malaria in the tropics has led him to directly opposite conclusions. He does not consider malaria to be a social disease, and diet, housing, economic status and general sanitation are factors that play a practically negligible part in its spread in intensely malarious regions in the tropics. In Malaya, the incidence of the disease showed no relation to housing or other social conditions of the people, depending solely on whether or not they were living within about half a mile from the breeding-places of Anophelines. The work already done in that country in the practical control of malaria by measures against mosquitos has yielded enormous results.

The acquirement of racial immunity may, in his opinion, take hundreds, or even thousands, of years.

Peryassú (A. G.). **Plantas como criadoiros de larvas de mosquitos.** [Plants as Breeding-places of Mosquito Larvae.]—*Arch. Hygiene*, iii, no. 2, pp. 279–282. Rio de Janeiro, September 1929.

Lists are given of the various Brazilian plants in which mosquito larvae have been observed, and of the mosquitos concerned, with notes on their preferences for given kinds of plants.

Lima (A. da Costa). **Sobre um novo *Anopheles* do Brasil.** [On a new *Anopheles* from Brazil.]—*Brasil-Medico*, xliii, no. 37, pp. 1100–1101, 1 fig. Rio de Janeiro, 14th September 1929.

Anopheles (*Arribalzagia*) *minor*, sp. n., is described from Estrella, Brazil. It is closely allied to *A. apicimacula*, D. & K.

Lima (A. da Costa). **Sobre alguns anophelineos encontrados no Brasil. (2a. Nota.)** [On some Anophelines found in Brazil. 2nd Note.]—*Suppl. Mem. Inst. Oswaldo Cruz*, no, 12, pp. 275–293, 18 pls., 33 refs. Rio de Janeiro, 31st December 1929.

In this second note [*cf. R.A. E.*, B, xvii, 85], the author discusses the classification of some Brazilian species of *Anopheles* that he has examined. He divides them into two subgenera, *viz.*, *Anopheles* (abdominal segments without scale-tufts), including *A. eiseni*, Coq., and, provisionally, *A.*

peryassui, D. & K., and *Arribalzagia* (with clearly visible tufts), including *A. mediopunctatus*, Theo., *A. intermedius*, Chagas, which is subject to considerable variation, *A. fluminensis*, Root, *A. maculipes*, Theo., and *A. minor*, Lima. A key is given to these species and to *A. mattogrossensis*, Peryassú, and *A. punctimacula*, D. & K. The genitalia of *A.* (*Stethomyia*) *nimbus*, Theo., which are described, lead the author to regard *Stethomyia* as a genus distinct from *Anopheles*. A note by Godoy is reproduced describing the oviposition of an Anopheline of the subgenus *Nyssorhynchus*.

Lima (A. da Costa). **Sobre algumas especies de** *Mansonia* **encontradas no Brasil.** [On some Species of *Mansonia* found in Brazil.]—*Suppl. Mem. Inst. Oswaldo Cruz*, no. 12, pp. 297–300, 2 pls., 5 refs. Rio de Janeiro, 31st December 1929.

Notes are given on the genitalia and other characters of *Taeniorhynchus* (*Mansonia*) *titillans*, Wlk., *T.* (*M.*) *pseudotitillans*, Theo., and *T.* (*M.*) *amazonensis*, Theo. The larvae of *T. titillans* cannot breathe solely the air dissolved in water. They died in a few hours in glasses containing water, but lived for 3–4 days if *Pistia stratiotes* was present. Other aquatic plants to which they attach themselves are *Eichhornia* and *Pontederia*.

Anopheles gambiae **in Natal, Brazil.**—*Science*, lxxi, no. 1843, p. 435. New York, N.Y., 25th April 1930.

Anopheles gambiae, Giles, stated to be the first species of the subgenus *Myzomyia* to be found in the New World, is recorded from Rio Grande do Norte, Brazil. It is thought to be of recent introduction.

Campos R. (F.). **Algo sobre la cromotaxia de las larvas del mosquito malárico** *Anopheles tarsimaculatus* **Goeldi.** [Notes on the Chromotaxy of the Larvae of *A. tarsimaculatus*.]—*Rev. Col. nac. Vicente Rocafuerte*, x, no. 32–35, pp. 3–6. Guayaquil, 1928.

El *Anopheles pseudopunctipennis* **Theob. Mosquito transmisor del tipo de paludismo pernicioso.** [*A. pseudopunctipennis*, the Vector of Malignant Tertian Malaria.]—*T.c.*, pp. 17–20.

Contribución al conocimiento de los Reduvidos del Ecuador. [A Contribution to the Knowledge of the Reduviids of Ecuador.]—*T.c.*, pp. 61–72.

The first paper includes lists of the various colour variations observed in larvae of *Anopheles tarsimaculatus*, Goeldi, in Ecuador, and the second records observations on *A. pseudopunctipennis*, Theo., in that country. The larvae occur in quiet, clear pools rich in Thallophytes, being often found together with those of *A. tarsimaculatus* and *Uranotaenia* spp. In the laboratory the pupal stage lasted three days.

The third paper is an annotated list of the Reduviid bugs found in Ecuador by the author. The genus *Triatoma* is represented by *T. dimidiata*, Latr., and *T. carrioni*, Larr. The latter readily attacks horses. In the laboratory one larva of this species lived for over 16 months, having 14 blood meals and moulting once. Another lived for over a year, had 9 blood meals and moulted three times. These larvae were fed on man and fowls.

Lowman (K. E.). **Health Conditions in St. Croix.**—*Milit. Surg.*, lxiv, no. 4, pp. 539–543, 2 figs. Washington, D.C., April 1929.

A recent mosquito survey of St. Croix has shown that *Anopheles albimanus*, Wied., is common, and that Culicines breed all over the island, particularly around habitations, the commonest being *Culex fatigans*, Wied. (*quinquefasciatus*, Say) and *Aëdes argenteus*, Poir. (*aegypti*, auct.). The island is almost free from malaria, but there has recently been a considerable influx of Porto Rican labourers, many of whom are infected with this disease, so that the prevalence of *A. albimanus* is a matter of importance. It is probable that *C. fatigans* is the chief vector of filariasis in St. Croix.

Simmons (J. S.) & St. John (J. H.). **The Prevalence and Distribution of Malaria on the Island of Corregidor, Philippine Islands.**—*Milit. Surg.*, lxiv, no. 5, pp. 710–733, 1 fig., 1 chart, 4 refs. Washington, D.C., May 1929.

Simmons (J. S.). **Malaria on the Island of Corregidor, P.I. II.**—*T.c.*, no. 6, pp. 906–911, 1 ref. June 1929.

Corregidor is a small island at the entrance to Manila Bay, and constitutes an important military post. The first of these papers contains a brief description of the topography of the island, a discussion of previous records of malaria, and an account of a survey, made in July 1928, to determine the degree of latent infection among the natives. This survey provided evidence that malaria is endemic on Corregidor, but during the wet season, in July and September 1928, neither adults nor larvae of Anophelines could be found. None of the streams on the island provides suitable breeding-places for Anophelines in the wet season, since they are scoured out at least every week by heavy rains.

The second paper gives the results of an Anopheline survey made in December 1928, during the dry season. The species found breeding were *Anopheles minimus*, Theo., the larvae of which constituted 68 per cent. of the total, *A. vagus*, Dön. (*rossi*, Giles, pool type), *A. maculatus*, Theo., *A. hyrcanus*, Pall., *A. ludlowi*, Theo., and *A. subpictus*, Grassi (*rossi*, Giles, river type). The adults captured included, in addition, *A. karwari*, James. It is recommended that carriers of malarial infection should be treated with quinine, and that control measures should be instituted in all potential breeding-places of *A. minimus*. All streams should be dusted each week with Paris green and road dust (1 : 100), and either subsoil drainage or concrete channels in the ravines should be provided to deal with seepage water in the dry season. It is possible that Anophelines reach Corregidor from the mainland, but it is unlikely that these would be of importance, provided that they were prevented from breeding.

Walker (J. H. C.). **Anti-malaria Measures in Malaya.**—*J. Roy. Army Med. Corps*, liv, no. 2, pp. 87–106, 14 figs., 5 refs. London, February 1930.

The first part of this paper is a review of the development of anti-malaria measures in the Federated Malay States (*cf. R.A.E.*, B, xviii, 73). The second part deals with the present state of mosquito control as directed specifically against *Anopheles ludlowi*, Theo., *A. umbrosus*,

Theo., and *A. maculatus*, Theo., which have been proved to be the chief carriers of the disease in Malaya. The problem is facilitated by the fact that these species are confined to three distinct zones, the characteristics of which are briefly indicated.

A. ludlowi occurs in the mangrove forest zone wherever the jungle is cleared, and *A. umbrosus* breeds there if the jungle is not disturbed. Temporary measures consist of complete levelling, draining and oiling; when possible, the sea is admitted at every high tide. Permanent measures are clearing and filling, or completely shutting out the sea by means of bunds and by putting in clean open drains in which sluice gates are fixed. *A. umbrosus* is most numerous in the coastal plain zone a little further from the sea, and in the coastal hills. It can everywhere be controlled by clearing the jungle, but on the hills *A. maculatus* immediately takes its place, as it finds suitable breeding-places in the streams running between them. In the plain zone when the jungle is cleared, the level of the ground water has to be lowered by means of earth drains; oiling is employed as a temporary measure.

The inland zone, which comprises most of the Malay Peninsula, is preferred by *A. maculatus*, which appears throughout the country in any clean running water to which sunlight has access; even the smallest seepage may be responsible for outbreaks of malaria. *A. umbrosus* is found but rarely, and *A. ludlowi* never. *A. maculatus* can be controlled by leaving the jungle-covered ravines untouched, but if it is necessary to clear them, an extensive programme of operations is necessary. They consist in the removal of the breeding-places by permanent measures where possible, all surface water being confined to subsoil drains or concrete surface channels. The system of drainage used is described in detail.

MANSELL (R. A.). **Note on Experiments towards the Production of a cheap Insecticide for Anti-mosquito Work.**—*J. Roy. Army Med. Corps*, liv, no. 2, pp. 123–127. London, February 1930.

An account is given of experiments in Peshawar with the object of obtaining an insecticidal solution suitable, as regards both its activity and cost, for use on a large scale in barracks, particularly against mosquitos. Of the various sprays tested, one containing kerosene, pure carbon tetrachloride, oil of wintergreen (synthetic methyl salicylate) and naphthalene, used in various combinations, proved to be the best, as in most of the experiments all the mosquitos were killed. The results obtained are tabulated, and the formula recommended for practical use is 1 per cent. medicinally pure carbon tetrachloride and 2 per cent. methyl salicylate in second quality kerosene, with the addition of a $\frac{1}{4}$ lb. naphthalene to each gallon, used at the rate of approximately 5 fl. oz. to 1,000 cu. feet. The spray is not directed at the individual mosquitos, but is applied first to the ceiling and then to the walls of the room; this has an obvious advantage over fumigation from the ground level, in that the insects are subjected at once to the full lethal effects of the spray and are not able to escape upwards through openings in the roof, etc. No sealing up of the room or removal of furniture, equipment, etc., is required.

The specifications for three qualities of kerosene in India are appended. If the second quality is used, the quantity that falls in the ordinary

spraying of a room does not stain fabrics. The effect of the spray was not increased by the addition of petrol. The naphthalene is not only insecticidal to some extent, but is also a deterrent to further invasion by insects. None of the solutions used was quite so effective against sandflies [*Phlebotomus*] as against mosquitos.

LATHBURY (E. B.). **An Apparatus for breeding out the Larvae of Mosquitoes.**—*J. Roy. Army Med. Corps*, liv, no. 2, p. 130, 2 figs. London, February 1930.

This apparatus consists of a wooden frame with two horizontal bars, $\frac{3}{4}$ in. apart at the top, and a rack at the bottom. The rack holds twelve jam jars for breeding the mosquito larvae. Round the top of each jar is tied a conical net; the narrow end is passed through the bars and a brass ring sewn just below the opening rests on them. The top of the net is closed with a wooden clip. The adult mosquitos fly up the net and readily enter a test tube passed down as far as the ring.

YACOB (M.) & SHAH (K. S.). **A preliminary Report on the Suitability of Paris Green as an Anopheline Larvicide as applied to Punjab Conditions.**—*Ind. Med. Gaz.*, lxv, no. 2, pp. 84–88, 11 refs. Calcutta, February 1930.

This is an account of experiments for the control of Anopheline larvae carried out in the Punjab with Paris green containing 57·7 per cent. arsenic trioxide. Field tests were made in a channel with a considerable amount of marginal and aquatic vegetation, in which *Anopheles subpictus*, Grassi, *A. culicifacies*, Giles, *A. stephensi*, List., and *A. fuliginosus*, Giles, were breeding. Larvae were commonest close to the banks and occurred up to a distance of 5 feet from them, but not in the centre of the channel, which was 15 feet wide. When the Paris green was mixed with road dust (1 : 100) and dusted on to the surface of the water at the rate of 1 gramme to 10 sq. yards, it killed 100 per cent. of the Anopheline larvae within 24 hours, but did not affect Culicine larvae, leeches, tadpoles, etc. Laboratory experiments confirmed these results, but also showed that Paris green did not deter the female Anophelines from ovipositing and did not affect the eggs or pupae. The larval stage at the beginning of autumn, under optimum conditions of temperature (mean maximum 95·9° F.; mean minimum 73·7° F.), was found to last 7–8 days, so that 6 days should be the maximum interval between two applications of Paris green at this season. When diluted at the rate of 1 part to 200 parts of road dust, Paris green only killed about 50 per cent. of the larvae. The apparatus used for preparing and applying the dust mixture is described.

PELLER (S.). **Die Malaria und deren Bekämpfung in Palästina.** [Malaria and its Control in Palestine.]—*Zbl. Bakt.* (1, Orig.), cxvi, no. 2–3, pp. 132–160, 10 refs. Jena, 28th March 1930.

This is a survey of the malaria problem in Palestine based on various published papers and reports, including that of the League of Nations Malaria Commission [*R.A.E.*, B, xiv, 55, 56]. It is concluded that in the rural districts destruction of Anopheline larvae and reduction of their breeding-places are not practicable. In European settlements,

direct mechanical prophylaxis, healthy dwellings and good food are the chief requirements. Measures against Anopheline breeding-places should be based on economic considerations.

GALLI-VALERIO (B.). **Observations sur les Culicidés, les Tabanidés, les Simulidés et les Chironomidés.**—*Zbl. Bakt.* (1, Orig.), cxvi, no. 2–3, pp. 220–224. Jena, 28th March 1930.

In these further records of observations in Switzerland [*cf. R.A.E.* B, xvii, 80], it is stated that the transport of larvae of *Anopheles maculipennis*, Mg., is usually attended by a high mortality if the water is not frequently renewed, but the author succeeded in carrying them with little loss in mid-summer for several hours in a thermos flask. It is again shown that the abundance of Tabanids in the Alps varies both with the year and with the place, and does not depend on the presence of cattle. It would seem that Tabanids leave their normal habitats only if man and animals pass through them, when the flies may follow for great distances.

D'HALLUIN (M.). **Dengue et moustiques.**—*Riviera scient.*, xvii, no. 1, pp. 7–12, 10 refs. Nice, 1930.

Attention is drawn to the possibility of an outbreak of dengue in France, in view of the increase in facilities of travel, whereby an infected person might reach the country while still infective to the mosquito vector. *Aëdes argenteus*, Poir. (*aegypti* auct.) has been met with at several places between Marseilles and Nice and in Corsica.

MASLOW (A. W.). **Das kritische Temperaturminimum der überwinternden Mücken.** [The critical minimum Temperature of hibernating Mosquitos.]—*Arch. Schiffs- u. Tropenhyg.*, xxxiv, no. 3, pp. 170–173. Leipzig, March 1930.

Experiments at Tomsk, Siberia, where winter temperatures are exceedingly low, showed that the critical temperature for *Anopheles maculipennis*, Mg., is about −40° C. [−40° F.]. For *Culex pipiens*, L., it is much higher, being about −17 to −18° C. [1·4 to −0·4° F.]. Shcherbakov's experiment on the effect of low temperatures on *A. maculipennis* [*R.A.E.*, B, xvi, 42] was repeated, and it was found that at an average temperature of −18° C. [−0·4° F.] with an average minimum of −23° C. [−9·4° F.], the females can live for weeks or even months; 2½ per cent. survived for nearly fifty days at an average of −18° C. and a minimum of −36° C. [−32·8° F.]. Three were given blood-meals in May, and one oviposited.

DE BUEN (E.). **Estudio experimental de algunas substancias larvicidas antianofélicas.** [An experimental Study of some larvicidal Substances against Anophelines.]—*Med. Países cálidos*, ii, nos. 5–6, pp. 401–430, 508–540, 14 figs., 3 diagr., 54 refs. Madrid, September & November 1929.

An account is given of field and laboratory experiments with various oils and other larvicides and with *Gambusia* for the control of *Anopheles maculipennis*, Mg., which is the only vector of malaria in the Spanish province of Cáceres. It is concluded that the best results are given by using *Gambusia* and supplementing its action by means of Paris

green. All collections of water, however small, are stocked with the fish and then dusted every ten days, the presence or absence of the fish being noted so that the supply may be renewed if necessary. The cost of the combined method is very little higher than that of dusting alone. It was found that ponds containing *Gambusia* only had to be dusted once in June and did not need dusting in July, August or September, whereas other ponds required dusting from March to October.

COLLADO (J. G.). **Anofelismo en el delta del Ebro.**—*Med. Países cálidos* ii, no. 5, pp. 436–438. Madrid, September 1929.

Adult Anophelines are very abundant in huts, etc., in the delta of the Ebro, but the larvae are difficult to find, owing to the extent of the water-surfaces in which they breed. Their natural enemies include the fish, *Cyprinodon hispanicus*, and Notonectid bugs. The malaria index of the adult Anophelines is very low, no infection being found in 200 specimens dissected.

BELLOGIN (—) & VICIANO (—). **Estudio experimental comparativo entre el gas ácido cianhídrico y la mezcla gaseosa de cloruro de cianógeno.** [An experimental comparative Study of Hydrocyanic Acid Gas and the gaseous Mixture of Cyanogen Chloride.]—*Med. Países cálidos*, ii, no. 1, pp. 3–19. Madrid, 30th January 1929. Abridged, in French, in *Bull. Off. int. Hyg. publ.*, xxii, fasc. 2, pp. 320–325. Paris, February 1930.

A number of comparative tests with hydrocyanic acid gas (HCN) and cyanogen chloride (ClCN) were made in view of the results obtained with the latter in the United States [*cf. R.A.E.*, B, xi, 145]. The amount of sodium cyanide used is 2·5 gm. per cu. m. against rats and 5 gm. against insects, half this amount of sodium chlorate being employed in each case. The two are dissolved separately, and the solutions are then mixed and poured into a container. The hydrochloric acid, at the rate of 18 cc. per cu. m., is poured in another vessel. By opening taps, the liquids are allowed to mix in a lower chamber where the gas is generated. The dose for rats kills adult insects, but not the eggs of lice. At the insecticide dose the eggs of *Pediculus humanus*, L. (*vestimenti*, Nitz.) are killed in 10–15 minutes, and adult insects in 5 minutes at most. The lachrymatory effect is very pronounced, which, in conjunction with the fact that the lethal dose for man is 0·9407 mg. per litre as against 0·3269 mg. for HCN, renders this fumigant very safe. It is cheaper than HCN and penetrates equally well. Its effect on foods is similar to that of HCN, and it does not injure the colour of delicate fabrics. It only affects nickel plating, at much higher doses, and such surfaces can be protected with grease. There is no danger of fire or explosion.

LAWSON (G. B.). **Myiasis.**—*Southern Med. J.*, xxii, no. 11, pp. 1003–1004, 3 refs. Birmingham, Ala., November 1929. (Abstract in *Trop. Dis. Bull.*, xxvii, no. 4, pp. 318–319. London, April 1930.)

A case of infestation of man by *Hypoderma lineatum*, Vill., is described. In the course of 3 or 4 months the larva made a simple, spiral ascent right round the trunk from the abdomen to the neck, and finally worked through the cheek.

HASE (A.). **Ueber ein einfaches und billiges Verfahren, Fliegenmaden zu züchten.** [A simple and cheap Method of Breeding Fly Larvae.] —*Zool. Anz.*, lxxxviii, no. 9–10, pp. 286–287. Leipzig, 1st May 1930.

The larvae of *Calliphora vomitoria*, L., and other flies may easily be reared in hard boiled eggs. A small piece of the shell at one end is broken away and some of the white removed. Into the hole thus made a little water and a piece of decaying meat, about the size of a pea, is introduced, and the whole put in a shady place. The flies, attracted by the smell of the meat, lay their eggs inside the shell, and the larvae, on hatching, feed on the contents, remaining within the shell. A few drops of water should be introduced from time to time, or the egg kept in a damp atmosphere. If it is fixed into moistened sawdust, the larvae, when ready to pupate, will leave the egg and bury themselves in the sawdust. On one egg 100–150 larvae may be reared.

LOUGHNAN (W. F. M.). **Bourgault's Cattle-fly Trap.**—*J. Roy. Army Med. Corps*, liv, no. 3, pp. 208–211, 3 figs. London, March 1930.

A simple and efficient trap that has been used with success in Mauritius for removing flies [*Stomoxys nigra*, Macq.] from the backs of cattle, is described and illustrated; a brief account of this has already been noticed [*R.A.E.*, B., xviii, 90]. During a season when flies are abundant, a black bullock (preferably tailless) may be employed as a decoy. This animal is driven round the vicinity and finally through the trap, when a number of flies have been collected. In view of the fact that a considerable reduction in the numbers of house-flies [*Musca*] occurred in dwellings on estates where this trap was in use, it is suggested that it might be employed in camps, cantonments, etc., in India and Egypt and against tsetse-flies [*Glossina*] in Africa. The trap is economical and not expensive to erect; the only outlay required for upkeep is for the renewal of the brushes, which are usually made of coconut leaves and last six weeks or more.

VAN DER MERWE (C. P.). **The Blow Fly Pest.**—*Hawkesbury Agric. Coll. J.*, xxvi, no. 10, pp. 139–140. Richmond, N.S.W., 31st October 1929.

A method is suggested for controlling blow-flies on sheep farms, based on the principle that insects can usually pass through a smaller aperture in the larval than in the adult stage [*cf. R.A.E.*, A, xi, 326]. Carcases in which the blow-flies will breed are to be supported over pits covered with metal screens of a mesh large enough to allow the maggots to crawl through to pupate in the pit, but too small to allow the adult flies to escape. The sides of the pit should be as nearly vertical as possible, and it should be large enough to ensure that all maggots from the carcases will drop on to the bottom, and not the sides. Loose soil should be provided at the bottom, in which the maggots will immediately bury themselves and pupate. Storm water must be kept out of the pits.

If there is so much difference in the size of troublesome species of blow-flies that a screen that will enable the larger maggots to pass through will not confine the smaller adults, two screens may be used, one with meshes large enough to admit the larger maggots, over the top of the pit, and another, with meshes small enough to keep in the smaller adults, about half way down it. Loose soil should be provided round

the edges of the lower screen for the larger maggots to pupate in, care being taken that the maggots dropping from the carcase through the upper screen do not fall on to the soil round the edges of the lower one. Fresh carcases should be placed below the old ones, and the latter, when dry, should be burned. Accumulations of dirt on the screens, in which the maggots might pupate, must be removed.

The suggested method not only provides a cheap means of attracting blow-flies and of preventing them from breeding unchecked in carcases, but it also permits the development and escape of their parasites. A permanent structure of masonry, galvanised iron or wood, above ground, may ultimately prove more satisfactory than a pit. A modification of the method might prove of use in controlling fruit-flies while allowing their parasites to increase.

SMIT (B.). **The Biological Control of Sheep Blow-flies in South Africa.**—*S. Afr. J. Sci.*, xxvi, pp. 441–448, 18 refs. Johannesburg, December 1929.

A list is given of the better known parasites of the sheep blow-flies, indicating their hosts and distribution. The Pteromalid, *Mormoniella vitripennis*, Wlk., is the only one recorded in South Africa, where it was first discovered by the author in 1924, attacking the pupae of *Lucilia sericata*, Mg. In the Karroo area the adults first appear about the middle of September. Only puparia that have become properly hardened are attacked. From 100 individuals of *L. sericata*, 1,041 adult parasites emerged, and 25 more were found dead in the puparia. In the case of *Chrysomyia albiceps*, Wied., and *Sarcophaga haemorrhoidalis*, F., the parasites are often unable to escape through the tough walls of the puparia. The developmental period of *M. vitripennis* varies in accordance with temperature, and in puparia of *L. sericata* lasts 12 days in summer, being 5 days longer than the minimum pupal period of the host. It is not an efficient parasite of blow-flies, since only pupae are attacked, and as the fly larvae usually pupate in the soil, over 90 per cent. thus escape parasitism.

The author considers that the Braconid, *Alysia manducator*, Panz., is more likely to prove a factor in the control of sheep blow-flies, since it attacks the larvae rather than the pupae. Though it has been successfully introduced into Australia, the advisability of introducing it into South Africa is questioned. Although it appears to confine its activities to carcase-feeding maggots, it is feared that those of *Wohlfahrtia euvittata*, Villen., which is probably an important factor in the control of the brown locust [*Locustana pardalina*, Wlk.], may be attacked. This Sarcophagid normally breeds in carrion, on which it subsists between outbreaks of the locust.

A. manducator is therefore being studied in strict confinement. From 800 parasitised puparia of *L. sericata* sent from England on 22nd November by the Imperial Bureau of Entomology, 206 parasites emerged between 28th February and 8th March. Full-grown larvae of *L. sericata* were exposed to the emerging parasites. Oviposition began 3 days after emergence, only larvae in decaying meat being attacked. The first adults of the second generation began to emerge on 23rd April; in some puparia, the larvae of which were parasitised on 3rd March, full-grown parasite larvae in their cocoons were found on 8th July, four months later. Altogether 2,389 larvae of *L. sericata* were exposed to the parasites. From these, 1,042 adult flies and only 40 parasites

emerged ; dissections of puparia suggest that a few more parasites will emerge in the spring. *A. manducator* was also successfully reared on the hairy maggots of *Chrysomyia albiceps* (from which the Australian *C.* (*Pycnosoma*) *rufifacies*, Macq., is distinct). The parasites, however, seemed to have great difficulty in piercing the skin of these larvae, partly owing to its thickness and partly owing to the activity of the maggots, which in some instances catch and pierce them with their sharp mouth hooks. Six *Wohlfahrtia* larvae were exposed to the parasites for three days. Two of these maggots developed to the adult stage, two died in their puparia, and two were healthy pupae when this paper was written.

Holdaway (F. G.) & Evans (A. C.). **Parasitism a Stimulus to Pupation : *Alysia manducator* in relation to the Host *Lucilia sericata*.**—*Nature*, cxxv, no. 3155, pp. 598–599, 4 refs. London, 19th April 1930.

From the fact that both larvae and puparia of *Lucilia sericata*, Mg., were recovered from the soil surrounding baits exposed in the autumn, in the south of France, it appeared that hibernation could take place in either stage. It was found, however, that the percentage of parasitism in larvae that had not pupated within 8 days of being brought in from the field was negligible, practically all parasites being obtained from the puparia, or from larvae that pupated soon after collection. Further observations confirmed the idea that there was a relation between the pupation of the host and parasitism. It appears that the retardation by low temperatures of the physiological events normally leading to pupation may be overcome by a stimulus contributed by parasitism, and the authors suggest that this is provided by the secretion injected at the time of oviposition, which causes temporary paralysis of the host larva. This would also account for cases of host pupation as a result of injection without the deposition of an egg and thus explain why all the puparia obtained did not yield parasites. More than 90 per cent. of the parasitism observed was caused by *Alysia manducator*, Panz., the rest being due to *Aphaereta minuta*, Nees, which appears to produce an effect similar to that of *A. manducator*.

Davies (W. M.). **Parasitism in Relation to Pupation in *Lucilia sericata*, Meig.**—*Nature*, cxxv, no. 3160, pp. 779–780. London, 24th May 1930.

Observations in North Wales during the winter of 1929–30 confirmed the view that the hibernation of *Lucilia sericata*, Mg., takes place in the larval stage [*R.A.E.*, B, xvii, 151], and during this time not a single puparium was collected. From many thousands of larvae obtained from living sheep during the summers of 1928 and 1929 no parasite was bred. This fact provides negative evidence in support of the view of Holdaway and Evans [see preceding paper] that pupation among hibernating larvae is stimulated by parasitism. Parasitism is absent or of very rare occurence among larvae from living hosts in spite of the fact that the parasite, *Alysia manducator*, Panz., has been observed in numbers near carrion in several districts of North Wales. It is well known that this parasite is primarily attracted by the odour of the carrion. It therefore appears that live sheep attacked by the larvae of *L. sericata* offer no attraction to the ovipositing females of *A. manducator* and that larvae in this environment escape parasitism.

PAPERS NOTICED BY TITLE ONLY.

SCHWETZ (J.). **Contributions à l'étude de la biologie de** *Taeniorhynchus* (*Mansonioides*) *africanus* **et de** *Taeniorhynchus* (*Coquillettidia*) *aurites* **au Congo Belge.**—*Rev. Zool. Bot. afr.*, xviii, fasc. 3–4, pp. 311–329, 11 figs. Brussels, 15th January 1930.

SCHOUTEDEN (H.). **Un genre et trois espèces de moustiques nouveaux pour la faune congolaise.**—*Rev. Zool. Bot. afr.*, xviii, fasc. 3–4, pp. 431–433. Brussels, 15th January 1930.

CAMPOS R. (F.). **Un año a caza de criaderos de mosquitos por los pantanos de Guayaquil y alrededores.** [A Year's Mosquito Survey in the Marshes at and around Guayaquil.]—*Rev. Col. nac. Vicente Rocafuerte*, xi, no. 36–37, pp. 17–62. Guayaquil, 1929. [*Cf. R.A.E.*, B, xiv, 152.]

MCKINLEY (E. B.). **The Salivary Gland Poison of the** *Aëdes* [*argenteus*] *aegypti.*—*Proc. Soc. Exp. Biol. Med.*, xxvi, no. 9, pp. 806–809, 6 refs. New York, N.Y., June 1929.

PEUS (F.). **Bemerkungen über** *Theobaldia subochrea* **Edw.** [*T. subochrea* specifically distinct from *T. annulata*, Schr.]—*Mitt. deuts. ent. Ges.*, i, no. 4, pp. 52–60, 6 figs., 16 refs. Berlin, April 1930.

SHUTE (P. G.). **A Contribution to the Biology of** *Taeniorhynchus richiardii* **(Dip.)** [in England].—*Entomologist*, lxiii, no. 805, pp. 133–136. London, June 1930.

SHORTT (H. E.). **The Life-history of** *Leishmania donovani* **in its Insect** [*Phlebotomus argentipes*, Ann. & Brun.] **and mammalian Hosts.**—*Trans. 7th Cong. Far East. Ass. Trop. Med. 1927*, iii, pp. 12–18. Calcutta [1930]. [*Cf. R.A.E.*, B, xiv, 143 ; xvi, 168.]

BARRAUD (P. J.) & COVELL (G.). **The Morphology of the buccal Cavity of the Mosquito** [including a Grouping of 86 Species of *Anopheles* based on the bucco-pharyngeal Armature of the Females].—*Trans. 7th Cong. Far East. Ass. Trop. Med. 1927*, iii, pp. 98–102. Calcutta [1930].

BOREL (E.). **Nomenclature des moustiques de la Cochinchine et du Sud Annam.** [List of Species.]—*Trans. 7th Cong. Far East. Ass. Trop. Med. 1927*, iii, pp. 165–168. Calcutta [1930].

BOREL (E.). **Sur les moeurs des** *Anopheles* **en Cochinchine.** [Key to Larvae and Adults based on Bionomics.]—*Trans. 7th Cong. Far East. Ass. Trop. Med. 1927*, iii, pp. 169–171. Calcutta [1930].

SINTON (J. A.). **The Identification and Classification of the Species of the Genus** *Phlebotomus*, **with some Remarks on their geographical Distribution in Relation to Disease.**—*Trans. 7th Cong. Far East. Ass. Trop. Med. 1927*, iii, pp. 172–180, 1 pl., 30 refs. Calcutta [1930]. [*Cf. R.A.E.*, B, xiii, 121 ; xvii, 30, etc.]

[BOGOYAVLENSKIĬ (N.).] **Богоявленский (Н.). Quelques observations sur la biologie de phlébotomes à Kazakh.** [*In Russian.*]—*Arch. Inst. Microbiol. Hyg. Azerbaidjan*, i, no. 1–2, pp. 126–135, 1 ref. Baku, 1929. (With a Summary in French, p. 156.) [See *R.A.E.*, B, xviii, 78.]

[KHODUKIN (N. I.).] **Ходукин (Н. И.). An Attempt to infect** *Phlebotomus* **with** *L. canis* **(Nicolle)** [canine leishmaniasis]. [*In Russian.*]—*Meditz. Muisl' Uzbekistana*, ii(vii), no. 3, pp. 53–68, 2 pls., 48 refs. Tashkent, December 1927. (With a Summary in French, p. 135.) [For abridged account see *R.A.E.*, B, xvii, 9–10.]

[Pavlovskiĭ (E. N.) & Khodukin (N. I.).] **Павловский (Е. Н.) и Ходукин (Н. И.). On the Anticoagulin and other effective Substances contained in the Tick,** *Ornithodorus papillipes* **Bir.**—[*In Russian.*]—*Meditz. Muisl' Uzbekistana*, ii (vii), no. 7–8, pp. 8–13, 12 refs. Tashkent, April-May 1928. (With a Summary in French, p. 92.) [*Cf. R.A.E.*, B, xvii, 227.]

[Perfil'ev (P. P.).] **Перфильев (П. П.). On the Anatomy of the Sandfly** [*Phlebotomus*] **Larvae.** [*In Russian.*]—*Meditz. Muisl' Uzbekistana*, ii (vii), no. 9–10, pp. 13–26, 19 figs., 12 refs. Tashkent, June-July 1928. (With a Summary in German, p. 96.) [*Cf. R.A.E.*, B, xvi, 208.]

Phillips (J. F. V.). **The Application of ecological Research Methods to the Tsetse (*Glossina* spp.) Problem in Tanganyika Territory: a preliminary Account.** *S. Afr. J. Sci.*, xxvi, pp. 438–440. Johannesburg, December 1929. [*Cf. R.A.E.*, B, xviii, 61.]

Kröber (O.). **Die Tabanidensubfamilie Silvinae der neotropischen Region.** [The Tabanid Subfamily Silvinae of the Neotropical Region.]—*Zool. Anz.*, lxxxviii, no. 9–10, pp. 225–239, 11 figs. Leipzig, 1st May 1930.

Kröber (O.). **Die Pityocerini (Tabanidae) der neotropischen Region.** [The Pityocerini of the Neotropical Region.]—*Zool. Anz.*, lxxxviii, no. 11–12, pp. 305–312, 5 figs. Leipzig, 10th May 1930.

Kröber (O.). **Die Stenotabaninae und die Lepidoselaginae Südamerikas.** [The South American and West Indian Tabanids of the Subfamilies Stenotabaninae and Lepidoselaginae.]—*Encyc. ent.*, Sér. B, II. Dipt., v, pp. 101–154, 4 pls. Paris, 1929 [1930].

Séguy (E.). **Une pangonie nouvelle du Maroc** [*Pangonia surcoufi*, sp. n.].—*Encyc. ent.*, Sér. B, II. Dipt., v, p. 100. Paris, 1929 [1930].

Falcoz (L.). **Diptères pupipares du Muséum national d'Histoire naturelle de Paris. Hippoboscidae.**—*Encyc. ent.*, Sér. B, II. Dipt., v, pp. 27–54, 8 figs. Paris, 1929 [1930].

Henry (A.) & Dinulescu (G.). **Le deuxième stade larvaire de** *Gastrophilus inermis*.—*Encyc. ent.*, Sér. B, II. Dipt., v, pp. 171–175, 6 figs., 3 refs. Paris, 1929 [1930]. [*Cf. R.A.E.*, B, xviii, 12, 99.]

Wagner (J.). **Katalog der palaearktischen Aphanipteren.**—Med. 8vo, 55 pp., 9 pp. refs. Vienna, F. Wagner, 1930. Price, *M.*7.50.

[Wagner (J.).] **Вагнер (J.). Aphanipterenfauna Jugoslaviens.** [The Fleas of Jugoslavia. (*In Serbian.*)]—*Acta Soc. ent. jugoslav.*, iii–iv (1928–29), fasc. 1–2, reprint 35 pp., 1 pl., 5 figs. Belgrade [1930]. (With a Summary in German.)

Sharif (M.). **A Revision of the Indian Siphonaptera. Part I.—Family Pulicidae** [including *Xenopsylla hussaini*, sp. n., and *X. sewelli*, sp. n., both on *Gerbillus indicus*]. —*Rec. Ind. Mus.*, xxxii, pt. 1, pp. 29–62, 13 figs. Calcutta, March 1930.

Hall (M. C.). **Parasites and parasitic Diseases of Sheep.**—*Fmrs.' Bull. U.S. Dept. Agric.*, no. 1330, revd. edn., 35 pp., 34 figs., 4 refs. Washington, D.C., July 1929. [*Cf. R.A.E.*, B, ix, 110; xii, 67.]

Schlotthauer (C. F.) & Essex (H. E.). **Pulmonary Acariasis in the Monkey.** [Record of undetermined Mites in Lungs of *Macacus rhesus* in U.S.A.] —*J. Amer. Vet. Med. Ass.*, lxxvi, no. 2, pp. 243–246, 3 figs., 1 ref. Detroit, Mich., February 1930.

Séguy (W.). **Etude sur les Diptères à larves commensales ou parasites des oiseaux de l'Europe occidentale.**—*Encyc. ent.*, Sér. B, II. Dipt., v, pp. 63–82, 27 figs., 31 refs. Paris, 1929 [1930].

In the course of this paper on Diptera (other than Pupipara) found breeding in birds' nests or infesting nestlings, the Pteromalid, *Mormoniella vitripennis*, Wlk. (*Nasonia brevicornis*, Ashm.), is recorded from *Muscina stabulans*, Fall., *Stomoxys calcitrans*, L., *Musca domestica*, L., *Calliphora erythrocephala*, Mg., and the Sciomyzid, *Neottiophilum praeustum*, Mg., in birds' nests in France.

Alexander (C. P.). **The Genus *Sigmatomera* Osten Sacken with Observations on the Biology by Raymond C. Shannon.**—*Encyc. ent.*, Sér. B, II. Dipt., v, pp. 155–162, 8 figs., 10 refs. Paris, 1929 [1930].

A key to the adults of the American Tipulid genus *Sigmatomera* is given, and two new species are described. A note by R. C. Shannon states that the larvae of *S. shannoniana*, sp. n., were found in Brazil in tree-holes, during searches for the larvae of *Aëdes argenteus*, Poir. (*aegypti*, auct.). In captivity some 20 larvae of the Tipulid destroyed about 2,500 larvae of *A. argenteus*, but in nature they probably prey on other organisms as well.

Séguy (E.). **Notes sur les moustiques. III.**—*Encyc. ent.*, Sér. B, II. Dipt., v, pp. 177–178, 5 refs. Paris, 1929 [1930].

The capture in northern Greece of a female of *Anopheles gambiae*, Giles (*costalis*, Theo.), a mosquito previously unknown in Europe, is recorded. Very brief notes on several Culicines are given.

Martin (H. M.). **The Transmission of Surra by Species of *Tabanus*. A historical Review.**—*J. Amer. Vet. Med. Ass.*, lxxvi, no. 2, pp. 221–238, 38 refs. Detroit, Mich., February 1930.

This is a review of the literature on the transmission of surra by Tabanids and other Diptera in India, Malaya, the Dutch East Indies and the Philippine Islands. Most of the work has been published since 1912, and has been noticed in this *Review* [B, i, 113, 202; v, 38; xi, 216; xvi, 86, 108; etc.].

Allen (H.). **Observations on an Outbreak of Equine Surra, with special Reference to the Question of Vectors, and to Measures for Control.**—*Vet. J.*, lxxxvi, no. 2, pp. 51–63, 49 refs. London, February 1930.

An account is given of an outbreak of surra among horses in a remount depot in the Punjab, and literature on the bionomics of Tabanids and other blood-sucking Diptera and on their relation to the transmission of surra is reviewed. The outbreak lasted from the middle of November to the end of December and was confined to animals in one restricted area of the depot. Blood-sucking flies, particularly *Stomoxys*, were numerous throughout the depot in October, but much less so by mid-November, and were not in evidence at all in December. It seems unlikely that Tabanids would occur as late as November, and none could

be found during the outbreak. It therefore appears that flies were not the only vectors of the disease. No ticks were found during the outbreak. The author considers that all blood-sucking flies should be regarded as potential vectors of surra and suggests measures for controlling them.

MACLEAN (G.). **A Report on Human Trypanosomiasis in Tanganyika Territory for the Year ending 31st December 1928.**—*Ann. Med. Sanit. Rep. Tanganyika Terr., 1928*, pp. 170–185. London, 1929.

The work on trypanosomiasis carried out in Tanganyika Territory during the year 1928 is reviewed. The extent to which the principles and methods laid down by the International Commission for the control of sleeping sickness [*R.A.E.*, B, xvii, 47] can be applied to this country are discussed. It is concluded that the collection of scattered forest populations into large farming settlements on the edge of the forest or in the forest itself is a safe and feasible proceeding that facilitates the control of the disease, simplifies administration, and, in suitable circumstances, lays the foundation for the building up of stable and progressive communities. In the majority of 1,500 cases that came under observation during the year, and in many hundreds of others observed in previous years, there were definite histories of living in tsetse areas in the vicinity of infected persons, and although in the case of hunters and fishermen a game-fly-man cycle of the parasite may possibly be maintained, it is clear that during an epidemic the only vertebrate host of importance is man. When the shore of Lake Tanganyika between Bangwe point and Kigoma town was being cleared, it was found that *Glossina palpalis*, R.-D., was breeding in numbers of caves and ledges, and it is not yet known whether the destruction of the scrub will be effective in controlling the fly or whether the rocks alone afford sufficient cover.

MCHARDY (J. W.). **Report on a general Survey of Anopheline Conditions on the Tanga-Arusha Railway.**—*Ann. Med. Sanit. Rep. Tanganyika Terr., 1928*, pp. 225–233, 3 refs. London, 1929.

During the period from 28th August 1928 to 21st February 1929 a thorough search for the breeding-places of Anophelines was carried out in the neighbourhood of selected places along the Tanga-Arusha Railway. The following species were reared : *Anopheles gambiae*, Giles, *A. mauritianus*, Grp., *A. funestus*, Giles, *A. marshalli*, Theo., *A. natalensis*, H. & H., *A. rhodesiensis*, Theo., *A. cinereus*, Theo., and *A. pretoriensis*, Theo. The author does not consider that the danger of passengers becoming infected with malaria in the train is sufficiently great to warrant control measures being undertaken along the railway unless they are necessitated by the health of the district itself.

KIRSCHNER (L.) & TIMMERMANN (W. A.). **Untersuchungen über *Bartonella*-Infektionen der Ratten in Niederländisch-Indien.** [Investigations on *Bartonella* Infections of Rats in the Dutch East Indies.]—*Zbl. Bakt.* (1, Orig.), cxv, no. 7–8, pp. 437–440, 21 refs. Jena, 20th February 1930.

At Bandoeng, Java, laboratory white rats and white mice are free from infection with *Bartonella* [*muris*], whereas the house-rat, *Mus*

rattus griseiventer is nearly always infected. White rats and mice are, however, susceptible, and ectoparasites of rats, such as *Polyplax* (*Haematopinus*) *spinulosa*, Burm., and mites, can acquire infection and harbour living *Bartonella* bodies [*cf. R.A.E.*, B, xvii, 132].

Nieschulz (O.) & Wawo-Roentoe (F. K.). **Ueber die Zucht von Zecken.** [The Breeding of Ticks.]—*Zbl. Bakt.* (1, Orig.), cxv, no. 7–8, pp. 486–488, 1 ref. Jena, 20th February 1930.

A comparatively simple method of breeding the tick, *Rhipicephalus sanguineus*, Latr., is described. Engorged females were sent from Java, and during the 5-week journey to Utrecht they had oviposited and larvae had hatched from the eggs. To permit feeding special covers were devised that were attached to the backs of the hosts. Guineapigs were found satisfactory for feeding all stages, mice being also suitable for the larvae, and dogs for the adults.

Cooley (R. A.). **The Montana Tick Parasite Expedition to Africa.**—*Science*, lxxi, no. 1842, pp. 419–420. New York, N.Y., 18th April 1930.

The purpose of the expedition to Africa of the Montana State Board of Entomology was to obtain information on parasites of ticks [*cf. R.A.E.*, B, xvii, 123]. Ticks were collected from over 1,500 domestic and wild animals over as large an area as possible in Kenya and all the provinces of South Africa. A species of *Ixodiphagus*, possibly identical with *I. caucurtei*, du Buysson, was obtained in several instances from *Hyalomma aegyptium*, L., in the Transvaal. Reports were also received from South Africa of two undetermined Chalcid parasites of adult ticks, which the author had no opportunity of studying, and the discovery of an unidentified tick parasite was recorded from Nigeria.

Carrión (A. L.). **Third Report on a Rat-flea Survey of the City of San Juan, Porto Rico.**—*Porto Rico J. Publ. Hlth. Trop. Med.*, v, no. 2, pp. 158–166, 7 charts. San Juan, P.R., December 1929.

During the third and last year of this survey [*R.A.E.*, B, xvi, 163; xvii, 26], covering the period July 1928–June 1929, the concentration of rats was found to be moderately higher toward the residential and commercial zones, and *Mus norvegicus* predominated in almost all sections. Fleas were found on 68 per cent. of the rats captured and were most highly concentrated at the docks. The total number of fleas captured was 1,970, of which 1,055 were *Xenopsylla cheopis*, Roths. The average number of fleas per rat was 7·9. Other fleas taken were *Echidnophaga gallinacea*, Westw., *Ctenocephalus canis*, Curt., or *C. felis*, Bch., and *Pulex irritans*, L. The flea prevalence and the atmospheric humidity curves show marked dissociation during the second half of the year.

Yearbook of Agriculture 1928.—8vo, v+1145 pp., 250 figs., 30 maps. Washington, D.C., U.S. Dept. Agric., 1929.

Among the papers of entomological interest are the following: Cattle-grub Damage reduced by various Methods of Control, by F. C. Bishopp (pp. 181–182), in which the annual loss caused by *Hypoderma*

in the United States is estimated at approximately £10,000,000; the Cattle Tick [*Boophilus annulatus*, Say] passes from Oklahoma after a Battle of 22 Years, by L. J. Allen (pp. 184–185); Fleas controlled by Creosote Oil Sprays and other Insecticides, by F. C. Bishopp (p. 297), in which the author recommends that creosote be used for spraying the breeding-places of fleas or that flaked naphthalene be scattered over the floor at the rate of 5 lb. to a room and left for 8–10 hours; and Fly Control Methods, by R. P. Hotis (pp. 300–302), in which it is pointed out that three methods of control have been used with success for the control of the house-fly [*Musca domestica*, L.], the stable fly [*Stomoxys calcitrans*, L.] and the horn fly [*Lyperosia irritans*, L.] on dairy cattle, namely, the frequent removal of manure and the treatment of the soil on which it has stood with fuel oil distillate at the rate of 5 gals. to each 100 sq. ft. of ground, the use of bait traps, and spraying with kerosene extract of pyrethrum.

[Pavlovskiĭ Pawlowsky (E. N.) & Stein (A. K.). **Experimentelle Untersuchung über die Wirkung der, eine eigenartige Dermatitis beim Menschen hervorrufenden, Milbe** *Rhyzoglyphus hyacinthi* **(Fam. Tyroglyphidae).** [Dermatitis experimentally produced in Man by means of the Tyroglyphid Mite, *R. hyacinthi*.]—*Arch. Dermat. Syph.*, clviii, no. 2, pp. 443–449, 4 figs. Vienna, 1929. (Abstract in *Trop. Dis. Bull.*, xxvii, no. 4, pp. 322–323. London, April 1930.)

A detailed description is given of the experimental production of a superficial dermatitis in man by means of the bulb mite, *Rhizoglyphus hyacinthi*, Banks. The symptoms quickly appeared when crushed mites from onions were rubbed into, or merely left in contact with, the human skin.

Weill (R.). **La présence d'un infusoire du genre** *Isotricha* **(*I. caulleryi* n. sp.) chez un insecte (*Periplaneta americana* Forbes) et sa signification possible.** —*Arch. Zool. exp.*, lxix, no. 1, Notes & Rev., pp. 21–26, 7 figs., 5 refs. Paris, 30th July 1929. [Recd. 1930.]

A species of *Isotricha*, *I. caulleryi*, sp. n., is recorded for the first time from an invertebrate host, having been found in *Periplaneta americana*, L., from a ship at Saigon, about 20 being observed in each of 4 cockroaches. In view of the fact that it is not known how ruminants become infected with *Isotricha*, the possibility of an insect vector is important.

Bacigalupo (J.). *Hymenolepis nana* **v. Siebold 1852.**—*Med. Países cálidos*, ii, no. 2, pp. 177–182, 2 figs. Madrid, 1929.

Hymenolepis nana is the Cestode occurring most frequently in the human intestine in Argentina. It can develop with or without an intermediate host. The insects found experimentally by the author to serve as intermediate hosts are *Tenebrio molitor*, L., *T. obscurus*, F., and, probably, *Xenopsylla cheopis*, Roths. [*R.A.E.*, B, xvi, 230; xvii, 26].

Echalecu (F. O.). **La *Hymenolepis nana* en España.**—*Med. Países cálidos*, ii, no. 4, pp. 305–333, 4 figs., 79 refs. Madrid, 1929.

The author found development of *Hymenolepis nana* to occur in adults of *Tenebrio molitor*, L., *T. obscurus*, F., and *Xenopsylla cheopis*, Roths. ; in the case of the last-named insect further proof is required. It would appear that in Spain the transmission of the Cestode to man is a direct one.

Pittaluga (G.). **El problema del paludismo en las grandes obras hidráulicas.** [The Malaria Problem in extensive Water-engineering Works.]—*Med. Países cálidos*, ii, no. 6, pp. 497–507. Madrid, 1929. (With a Summary in French.)

The history of the malaria problem in connection with irrigation and drainage works is discussed. The species of *Anopheles* occurring in Spain are *A. maculipennis*, Mg., which is found everywhere ; *A. bifurcatus*, L., which is present in various localities ; *A. hyrcanus* var. *pseudopictus*, Grassi, which occurs in rice-fields and on the coast, being common in Valencia and Tortosa ; and a few other species of minor importance, such as *A.* (*Myzomyia*) *hispaniola*, Theo.

Monteiro (J. L.). **Sobre a transmissão do virus da febre amarella pelas fézes de persevejos infectados.** [The Transmission of the Yellow Fever Virus by the Faeces of infected Bugs.]—*Brasil-Medico*, xliii, no. 35, pp. 1037–1040. Rio de Janeiro, 31st August 1929.

The infection of *Macacus rhesus* with yellow fever has been obtained by subcutaneous injection of an emulsion of the faeces of *Cimex lectularius*, L. The material was obtained from 2 to 12 days after the bugs had fed on an infected monkey. It is, therefore, possible that bugs may constitute a reservoir of infection in dwellings, in the absence of *Aëdes argenteus*, Poir. (*aegypti* auct.), and that the virus may be introduced through lesions in the skin.

Philip (C. B.). **Possibility of hereditary Transmission of Yellow Fever Virus by *Aëdes aegypti* (Linn.).**—*J. Exptl. Med.*, l, no. 6, pp. 703–708, 5 refs. New York, December 1929.

Several attempts to obtain the passage of yellow fever virus from infective mosquitos, *Aëdes argenteus*, Poir. (*aegypti*, auct.), to their eggs and offspring all gave negative results, confirming those obtained in a previous experiment [*R.A.E.*, B, xvi, 181]. It is concluded that under the conditions of the experiments, which are described, hereditary transmission is highly improbable.

Sawyer (W. A.) & Frobisher, jr. (M.). **The Filtrability of Yellow Fever Virus as existing in the Mosquito.**—*J. Exptl. Med.*, l, no. 6, pp. 713–718, 5 refs. New York, December 1929.

The authors' conclusions are as follows : The virus of yellow fever, as it exists in *Aëdes argenteus*, Poir. (*aegypti*, auct.), both in the so-called infective stage and in the intermediate condition termed the

" incubation period," is capable of passing through Berkefeld N filters when suspended in normal monkey serum, although earlier investigators have shown that the virus from infective mosquitos will not do so when suspended in physiological salt solution. The virus of yellow fever as it exists in mosquitos behaves with regard to filtration through Berkefeld N filters as does the virus in the blood of infective monkeys.

Davis (N. C.) & Shannon (R. C.). **Studies on Yellow Fever in South America. IV. Transmission Experiments with** *Aëdes aegypti*.—*J. Exptl. Med.*, 1, no. 6, pp. 793–801, 4 refs. New York, December 1929.

The following is largely taken from the authors' summary: Experiments are described in which batches of *Aëdes argenteus*, Poir. (*aegypti*, auct.) that had fed on monkeys (*Macacus rhesus*) in the early febrile stage of yellow fever failed to transmit the disease to normal monkeys in approximately 50 per cent. of the experiments. During the same time, over 80 per cent. of blood transfers were successful. Monkeys failing to show fever following mosquito bites later proved resistant to the inoculation of blood or tissues containing virus. The incubation period in monkeys following bites varied from less than 24 hours to 15 days, averaging somewhat longer in non-fatal than in fatal infections.

Davis (N. C.) & Shannon (R. C.). **Studies on Yellow Fever in South America. V. Transmission Experiments with certain Species of** *Culex* **and** *Aëdes*.—*J. Exptl. Med.*, 1, no. 6, pp. 803–808, 6 refs. New York, December 1929.

These experiments proved that *Aëdes scapularis*, Rond., is capable of transmitting yellow fever, but it is not known whether it becomes a factor in the dissemination of the disease. Its feeding habits do not preclude this possibility, and it also at times enters houses in search of blood. Tests have shown that the virus may survive for some time in the bodies of *A. serratus*, Theo., and probably also in *A. taeniorhynchus*, Wied., but it is not known whether these species ever become capable of transmitting the virus by their bites. The biting habits of the latter mosquito are such as to bring it under suspicion during the season of maximum prevalence, if yellow fever occurs in the vicinity. There is no evidence that *Culex fatigans*, Wied. (*quinquefasciatus*, Say) is able to transmit the disease, though some of the experimental animals bitten by this species have been relatively immune following inoculations containing the virus.

Shannon (R. C.), Burke (A. W.) & Davis (N. C.). **Observations on released** *Stegomyia aegypti* **(L.), with special Reference to Dispersion.**—*Amer. J. Trop. Med.*, x, no. 2, pp. 145–150. Baltimore, Md., March 1930.

In these experiments, which were carried out in Brazil, 3,500 adults of both sexes of *Aëdes argenteus*, Poir. (*Stegomyia aegypti*, auct.) were stained, and released in the bedrooms of a large house. Aqueous solutions of methylene blue (1 per cent.) and eosin (2 per cent.) were used very successfully for staining the mosquitos, but gentian violet (0·5 per cent. aqueous solution) was apparently toxic to them. Two

lots were given a blood meal before they were released, and two were allowed to feed on honey and water. In order to try to induce the mosquitos to remain in the house, earthenware pots filled with water were kept in various parts of it, and they were allowed to feed without being disturbed, some even being given special opportunities to engorge on one of the occupants. Geckos were seen to devour numbers of the released mosquitos, and many were doubtless eaten by spiders.

In the first experiment, search for stained mosquitos was made only in the house in which they were released, and was begun after an interval of a week. On the first day, 5·25 per cent. were recovered, and in the next seven days, a further 1·12 per cent. Gentian violet was used for staining in the second experiment, and no mosquitos were recovered when search was made two weeks later. In the third experiment, captures were begun in the neighbouring houses two days after the mosquitos had been liberated, and in the house of release 12 days later, by which time less than 1 per cent. remained there ; one female was found after 17 days in a house 120 metres away. In the fourth experiment, collecting was begun in the house of release and in the neighbouring houses on the day after the mosquitos had been liberated. On the first day, 53·4 per cent. were captured in the house of release and 0·75 per cent. in the neighbouring houses ; in the next five days 13 per cent. were captured in the house of release and 2·4 per cent. in the neighbouring houses.

The authors conclude that either the life of the mosquito is usually comparatively short in nature, or else dispersion is very thorough.

SHANNON (R. C.) & DAVIS (N. C.). **The Flight of *Stegomyia aegypti* (L.).**—*Amer. J. Trop. Med.*, x, no. 2, pp. 151–156, 1 plan, 2 refs. Baltimore, Md., March 1930.

In order to determine the range of flight of *Aëdes argenteus*, Poir. (*Stegomyia aegypti*, auct.), stained individuals were released in three villages in Brazil, and in the hold of a ship moored in a bay, 300 metres from the shore on one side and 900 metres on the other. In the first three experiments, in which over 20,000 mosquitos were used, collecting was begun in the villages 2–5 days after their release. Two individuals were recovered in houses more than 300 metres from the point of release, and 95 others at shorter distances. In the fourth experiment, in which 12,000 mosquitos were released, 7 individuals (males and females) were recovered in houses on the further shore, 950–1,000 metres from the ship, and 14 in houses on the nearer shore, 13 at distances of 300–350 metres, and one at least 1,000 metres from the ship.

Less than 0·4 per cent. of the mosquitos were recovered in the four experiments. The latest capture was made 13 days after release, and a week after release stained mosquitos were exceedingly scarce. This indicates either that dispersion is very thorough, widespread and rapid, or that mortality is very high.

DAVIS (N. C.) & SHANNON (R. C.). **The Location of Yellow Fever Virus in infected Mosquitoes and the Possibility of hereditary Transmission.**—*Amer. J. Hyg.*, xi, no. 2, pp. 335–344, 10 refs. Baltimore, Md., March 1930.

An account is given of experiments to locate the yellow fever virus in *Aëdes argenteus*, Poir. (*aegypti*, auct.) [*cf. R.A.E.*, B, xvii, 110 ; xviii, 8].

Three sets of monkeys (*Macacus rhesus*) were inoculated with various parts of infected mosquitos, the bites of which were not yet infective. The positive results following inoculation indicated an early dissemination of the virus, the presence of which was demonstrated in the head, thorax and abdomen of the insects. Transmission was also secured by the inoculation of the legs, salivary gland, mid-gut and hind-gut. No result was obtained from the inoculation of the haemocoelic fluid or of the mouth-parts. The faeces may sometimes transmit the virus [xvii, 213, 237], but the few experiments carried out did not indicate that these are highly infectious. Although it is probable that the ovaries contain the virus, no definite transmission has been secured from the inoculation of eggs laid by infected individuals, and it is improbable that infection can be transmitted to the next generation. Experiments to test the possibility that the virus may persist through the metamorphoses from the larval to the adult stages proved negative, and no evidence has been obtained that *A. argenteus* can become infected during the larval stage from feeding on the bodies of mosquitos containing the virus.

HUFF (C. G.). *Plasmodium elongatum* **n. sp., an Avian Malarial Organism with an elongate Gametocyte.**—*Amer. J. Hyg.*, xi, no. 2, pp. 385–391, 2 pls., 6 refs. Baltimore, Md., March 1930.

As the result of a study of the original descriptions, the author considers that the parasite causing avian malaria in the United States, recorded as *Plasmodium praecox* [*R.A.E.*, B, xvi, 61], is not identical with the organism described by Grassi and Feletti as *Haemamoeba praecox*. He therefore proposes the name *P. elongatum* for the American species, which he describes. Recent feeding experiments on birds infected with *P. elongatum* have shown that this parasite can develop in *Aëdes triseriatus*, Say, in addition to the mosquitos previously recorded [*loc. cit.*].

DUREN (A. N.). **Les mesures prises contre la fièvre jaune à Matadi en 1928.**—*Bull. Off. int. Hyg. publ.*, xxii, fasc. 2, pp. 287–306, 2 graphs, 1 ref. Paris, February 1930.

An outbreak of yellow fever occurred at the port of Matadi, Belgian Congo, in November 1927 and continued until February 1928. Drastic measures were taken to control *Aëdes argenteus*, Poir. (*Stegomyia fasciata*, F.) in the township, and to prevent the spread of the disease. Since a mosquito that has become infected with yellow fever remains infective for the whole of its life, it was decided that rigorous anti-mosquito measures should be continued for at least 100 days after the last case of the disease ; it was not considered likely that adult mosquitos would live longer.

Details are given of the species of mosquitos captured or bred during the campaign, most of which were recorded in a previous paper [*R.A.E.*, B, xvii, 142]. Of mosquitos captured in houses, 50 per cent. were *Culex fatigans*, Wied., and only 15 per cent. *A. argenteus*. Although the breeding-places of *A. argenteus* are mostly receptacles in and around houses, it also breeds in holes in the rock at a considerable distance from habitations. More than 100 receptacles were specially provided to attract females of *A. argenteus* for oviposition ; these were visited every

week and treated with a solution of sodium hypochlorite, as recommended by Roubaud [xv, 161], but a stronger one was used in order to kill the larvae that had already hatched as well as causing the dormant eggs to hatch. It was found that merely rinsing the receptacles in water was not enough. The seasonal abundance of *A. argenteus* at Matadi varies in accordance with the rainfall. The temperature is never low enough to render it inactive.

Blanc (G.) & Caminopetros (J.). **Recherches expérimentales sur la dengue.**—*Ann. Inst. Pasteur*, xliv, no. 4, pp. 367–436, 12 figs., 3 pp. refs. Paris, April 1930.

Most of the information contained in this paper on the transmission of dengue by *Aëdes argenteus*, Poir. (*Stegomyia fasciata*, F.), on the distribution of this mosquito in Greece, and on the methods of keeping the adults alive during the winter, has been noticed from other sources [*R.A.E.*, B, xvii, 62, 165, 169, 236, 239]. Additional matter includes fuller details of experiments, and a review of previous work on the transmission of dengue by mosquitos. Negative results were obtained in an attempt to transmit the disease by means of *Culex pipiens*, L.

Cazanove (F.). **Dengue et fièvre jaune.**—*Bull. Soc. Path. exot.*, xxiii, no. 2, pp. 155–161. Paris, 1930.

The author quotes numerous instances from the literature in which outbreaks of dengue fever have been followed by epidemics of yellow fever, and he suggests that the first cases of dengue should be taken as the signal for an immediate intensification of control measures against *Aëdes argenteus*, Poir. (*Stegomyia fasciata*, F.). Marchoux, in commenting on this paper, points out that as early observers had no criterion except clinical symptoms for the diagnosis of yellow fever, it is quite possible that mild cases were attributed to dengue. Moreover, it is useless to await cases of dengue before undertaking anti-mosquito work, which should be carried out continuously.

Roubaud (E.) & Toumanoff (C.). **Sur une race physiologique suractive du moustique commun, *Culex pipiens* L.**—*Bull. Soc. Path. exot.*, xxiii, no. 2, pp. 196–201, 3 figs., 9 refs. Paris, 1930.

An account is given of two biological strains of *Culex pipiens*, L. [*R.A.E.*, B, xvii, 108]. In the normal one, hibernation occurs and a blood meal is necessary for the maturation of eggs. In the other, described as autogenous, reproduction occurs throughout the year provided that the temperature is above 16–18°C. [60·8–64·4°F.], and the larvae have the power of accumulating a reserve of nutritive substances which permits the maturation of eggs in the resulting females without the necessity for further nourishment. A strain of this type has been maintained in an insectarium at an average temperature of 20° C. [68° F.] for about a year in a glass box in which the adults had access to water only. The generations succeeded one another in the normal manner, but the egg-masses seldom contained more than 40–80 eggs on an average (sometimes much less), and were not more than a

quarter of the size of those laid by the normal form. An examination of fourth stage larvae about to pupate that had been reared under the same conditions in dirty water showed that the reserve in the fat-body of the autogenous form was at least three times as great as in the normal type. In the normal adult, the fat-body does not develop until after emergence and as a result of nourishment. The autogenous form appears to be adapted to artificial conditions in buildings heated in winter, whereas the normal type would seem to represent the rural form of the species. No morphological differences are discernible in the two forms.

SAUTET (J.). **A propos de l'emploi des hypochlorites dans la lutte contre la fièvre jaune.**—*Bull. Soc. Path. exot.*, xxiii, no. 2, pp. 202–204, 2 refs. Paris, 1930.

An account is given of experiments in which eggs of *Aëdes argenteus*, Poir., were placed in distilled water and in polluted water, and in a second series, in distilled and polluted water to which had been added sodium hypochlorite at the rate of one drop to 20 c.c. of water. In distilled water the addition of sodium hypochlorite was unfavourable to the hatching of the eggs at ordinary temperatures (10–18° C. [50–64·4° F.]) and at 25° C. [77° F.], whereas larvae began to develop in distilled water alone. On the other hand, at 37° C. [98·6° F.] hatching was almost instantaneous in the chlorinated water and the larvae died in a short time, whereas no hatching occurred in distilled water alone. In polluted water similar results were obtained, except that at temperatures of 25° C. the development of larvae occurred both in the treated and untreated water. As only five eggs were used in each case, the results cannot be regarded as conclusive, but the author points out that, contrary to Bunau-Varilla's opinion that chlorine may be used for the control of *A. argenteus*, since it inhibits the action of micro-organisms that favour the hatching of the eggs [*R.A.E.*, B, xvii, 62], sodium hypochlorite may actually accelerate hatching at higher temperatures, although it seems to have the opposite effect at ordinary ones. It therefore appears that though this substance might be effective against *A. argenteus* in temperate climates, its value in hot countries is doubtful. Commenting on this paper, Roubaud points out that the concentration of chlorine suggested by Bunau-Varilla is too low to give practical results. Higher concentrations generally induce a high degree of hatching under conditions favourable to the development of the mosquito, but for purposes of sterilising receptacles it would be more practical to use concentrated solutions that would rapidly destroy the eggs even without inducing hatching.

STRICKLAND (C.) & ROY (D. N.). **Calcutta Rat Fleas. A Contribution to the Epidemiology of Plague in India.**—*Trans. R. Soc. Trop. Med. Hyg.*, xxiii, no. 5, pp. 497–502, 11 refs. London, 17th March 1930.

Observations on the prevalence and distribution of *Xenopsylla cheopis*, Roths., and *X. astia*, Roths., in Calcutta, were made from December 1925 to December 1926. The flea rate per 100 rats of all species from all sources for the whole year was 60·3. *Mus norvegicus*

(*decumanus*) and *Nesokia bengalensis* were the most prevalent species of rat, and the number of *X. cheopis* per 100 of the former species was 85, and of the latter 117, the figures for *X. astia* being 251 and 235. *X. cheopis* was most abundant during the rainy season (July to October) and least numerous in the cold weather (November to February), whereas *X. astia* reached its maximum in the hot weather (March to June) and its minimum during the rains. *Ctenocephalus felis* subsp. *orientis*, Jord., was found in small numbers for the first time. The authors suggest that an attempt should be made to correlate in certain localities, if not over the whole of India, the relative human plague incidence and the relative numbers of the different species of flea present. Other factors that should also be taken into consideration are the relative prevalence of rats in different localities, the relative prevalence of each species of rat and the flea indices of each species.

RAMSAY (G. C.). **The Factors which determine the varying Degrees of Malarial Incidence in Assam Tea Estates and the fundamental Principles governing Mosquito Control of Malaria in Assam.**— *Trans. R. Soc. Trop. Med. Hyg.*, xxiii, no. 5, pp. 511–518, 6 refs. London, 17th March 1930.

Observations on malaria control in the tea gardens of the Cachar District, Assam [*R.A.E.*, B, xviii, 30] have been continued. For approximately the last two years the estates have been surveyed at weekly intervals, and the author's previous observations have been confirmed, modified and extended. Two additional species of Anophelines are recorded, namely, *Anopheles theobaldi*, Giles, and *A. annandalei*, Prashad. A survey from 1st April 1927 to 17th May 1929, extending to over 27,000 dissections, proved clearly and conclusively that *A. minimus*, Theo., is almost entirely responsible for the transmission of malaria in Assam, and that the period of its infectivity in nature corresponds to the season of primary malarial infections in children (born after 31st December). The efficient control of malaria is therefore chiefly dependent on the control of the breeding-areas of this species during the period of the year when it can become infected and is transmitting malaria in nature, *viz.*, from about the middle of April until practically the end of the year. The suggestion that the cold, dry season was probably the best time to apply insecticides [*loc. cit.*] has been shown to be of no practical value, since the spleen rate on an estate where malaria had been efficiently controlled in 1927 and where the winter breeding-places of *A. minimus* had been treated up to the beginning of May, increased from 18 to 24 per cent. when the summer resorts of this mosquito were left untreated from June to September 1928. On two other estates where no practical anti-larval measures had been carried out during 1927 or the early part of 1928, the control of the summer resorts of *A. minimus* resulted in a decrease in spleen rates from 67 to 32 per cent. and 27 to 14 per cent. respectively. Thus the importance of controlling the summer breeding-areas of this mosquito is emphasised.

The factor determining the migration of *A. minimus* from a winter to a summer resort is rainfall, and to reach a suitable breeding-area safe from the dangers of flooding and flushing, the female may travel as much as a mile or more. The rate of movement of the water surface appears to be an important factor in the selection of sites.

In Cachar, as in the Federated Malay States, the level at which *Mimosa pudica* grows is an excellent indication of flood levels, and consequently of potential summer breeding-places. The most prevalent breeding-areas on tea estates during the monsoon periods are indifferently constructed drains. For this reason drains should be scientifically built and graded so that they are self-cleansing and easily flushed.

The breeding-areas of *A. minimus* within the half-mile circle of each estate were located weekly and the larvae destroyed by oiling. The results were satisfactory, and owing to careful organisation of the work, the cost of oiling all the controlled gardens was less than that for oil used on a single small unsurveyed hill station, anti-malarial work averaging about 37*s.* a month for each estate. The breeding-places of *A. minimus* are controlled in nature by flooding, flushing and heavy shade; the first two factors account for the healthiness of rice land and low-lying tea estates and the last for the freedom from malaria of land at higher levels under virgin jungle. The cutting of jungle with the consequent exposure of streams and the use of badly constructed drains produce favourable summer breeding-places for *A. minimus* and account for the high degree of malarial endemicity on certain types of plateau land and in hill-foot areas that are above flood level. In order to reduce expenditure, investigations are being carried out on the possibility of utilising flooding and flushing obtained by mechanical means, such as sluice gates, culverts, straightening of streams, etc. Experiments are also being made on the cultivation of various types of shade-giving plants for use in tea gardens. The combined advantages of absolute shade and drainage can be obtained in selected sites by sub-soil piping or the use of rubble-filled drains covered with turf. In selecting breeding-places, *A. minimus* usually avoids low-lying drains, seepages and swamps contaminated with iron-oxide bacteria and certain types of stagnant water containing various kinds of algae.

Lloyd (Ll.). **Some Factors influencing the Trypanosome Infection Rate in Tsetse Flies.**—*Trans. R. Soc. Trop. Med. Hyg.*, xxiii, no. 5, pp. 533–542, 1 fig., 8 refs. London, 17th March 1930.

The following is largely taken from the author's summary: Transmission experiments have been carried out with *Glossina tachinoides*, Westw., using two old laboratory strains of *Trypanosoma brucei* and a mixed strain obtained by feeding the flies alternately on animals infected with the two strains. When the strains were mixed, the rate of infection in the flies in the combined experiments was much greater than that obtained with either strain alone. The variation in the rate of infection in the individual groups makes it uncertain whether the higher rate was due to the mixing of the two strains. It is suggested, however, that the experiments should be repeated, since the rejuvenation of one old strain by another, if it occurs, has an important bearing on the epidemiology of trypanosomiasis. The virulence to white rats of the strain produced by mixing was greater than is usual with a newly isolated strain of *T. brucei*, equal to that of a strain 400 days old and distinctly greater than that of a strain 200 days old (these being the two strains from which it was obtained). The factors that influence the rate of infection in tsetse-flies by trypanosomes are so many that it is impossible to estimate with any degree of accuracy the transmissibility of any particular strain.

Wigglesworth (V. B.). **Some Notes on the Physiology of Insects related to Human Disease.**—*Trans. R. Soc. Trop. Med. Hyg.*, xxiii, no. 6, pp. 553–577, 6 figs., 17 refs. London, April 1930.

The following is the author's summary : The physiology of digestion in the cockroach is discussed, and the properties of the enzymes concerned are shown to be very similar to those of vertebrates. The digestive system of the tsetse-fly, *Glossina*, is compared with that of the bluebottle, *Calliphora*. The only adaptations to a diet of blood that have been noted are the loss of enzymes acting upon carbohydrates, a great increase in the activity of the proteolytic enzymes, and the acquisition of factors affecting blood coagulation. The function of the so-called " symbionts " in *Glossina* is discussed. It is suggested that they may contribute some accessory food factor which is lacking in the sterile diet of their host. The proventriculus and the peritrophic membrane to which it gives rise are described, and the bearing of these structures on the intestinal flagellates is pointed out.

The general nature of tracheal respiration is described, and the parts played by mechanical ventilation and diffusion are discussed in the light of Krogh's theory. A new theory, complementary to that of Krogh, is advanced ; according to this, the extent of air along the terminal tracheoles is controlled by the osmotic pressure of the tissue fluids, and since the osmotic pressure increases in active tissues, the supply of air is greatest where it is most needed. Experiments on the mosquito larva are described, by which this theory is substantiated. Some observations on the entry of oil into the tracheal system of mosquito larvae are described.

Blacklock (D. B.) & Gordon (R. M.). **The experimental Production of Immunity against metazoan Parasites and an Investigation of its Nature.**—*Ann. Trop. Med. Parasit.*, xxi, no. 2, pp. 181–224, 1 pl., 2 graphs, 31 refs. Liverpool, 22nd July 1927.

Blacklock (D. B.), Gordon (R. M.) & Fine (J.). **Metazoan Immunity : a Report on recent Investigations.**—*Op. cit.*, xxiv, no. 1, pp. 5–67, 7 figs., 3 graphs, 11 refs. 7th April 1930.

The parasite used in these researches on immunity, which were carried out in Sierra Leone, was the Calliphorid, *Cordylobia anthropophaga*, Grünb. In an appendix, by Marion Watson, dealing with the bacteriological investigation of *C. anthropophaga* in relation to the immunity that it produces, it is stated that the interior of eggs laid by flies bred without precautions to ensure sterility is sterile, as are also the newly hatched larvae. The intestinal tracts of third instar larvae contain many bacteria, which are probably derived largely from the skin or tissues of the host ; similar organisms occur in newly emerged adults hatched under sterile conditions.

Yorke (W.), Adams (A. R. D.) & Murgatroyd (F.). **Studies in Chemotherapy. II. The Action *in vitro* of normal human Serum on the pathogenic Trypanosomes, and its Significance.**—*Ann. Trop. Med. Parasit.*, xxiv, no. 1, pp. 115–163, 3 pp. refs. Liverpool 7th April 1930.

The following is mainly taken from the authors' summary : Contrary to the experience of previous investigators, the authors have succeeded

in showing that normal human serum exerts a markedly trypanocidal action *in vitro* at 37° C. (98·6° F.) on various strains of pathogenic trypanosomes, such as *Trypanosoma equiperdum*, *T. rhodesiense* and *T. congolense*. On the laboratory strain of *T. gambiense*, however, there was no trypanocidal action. These facts give an entirely new significance to the well-known phenomenon of the therapeutic action of human serum in experimentally infected mice, and appear to afford the strongest grounds for believing that man's immunity to infection with the pathogenic trypanosomes of stock, and his relative susceptibility to *T. gambiense*, are bound up with this property of his serum. Resistance to the cytolytic action of human serum is a fixed character of *T. gambiense*, surviving many years' passage through laboratory animals, but in *T. rhodesiense* it is acquired and lost relatively quickly. The authors have elaborated a hypothesis which affords a reasonable explanation of the data as regards the epidemiology of human trypansomiasis in Africa. They suggest that *T. gambiense* and *T. rhodesiense* are both identical with *T. brucei*, of which the natural reservoir is game, but the game trypanosome is not pathogenic to man because of the trypanocidal action of his blood. Man, under certain pathological and dietetic conditions, such as amoebic abscess of the liver or obstructive jaundice, loses the trypanocidal substance from his blood and he is then susceptible to the game trypanosome. Such an individual when infected develops *T. rhodesiense* ; such infections are seen typically in regions infested by *Glossina morsitans*, Westw., where the chief food supply of the fly is game or stock ; they are sporadic and unlikely to become epidemic. The authors believe that *T. gambiense* infections originated in the same manner, but that, having occurred in regions infested with *G. palpalis*, R.-D., where the contact between man and fly is more intimate, there was a correspondingly greater chance of infection from man to man. Prolonged man-*Glossina*-man passage has produced the modifications of the parasite that have resulted in the characters of *T. gambiense*, the most striking of which is its fixed resistance to the trypanocidal action of human serum. The authors indicate the manner in which experimental enquiry could be conducted in tropical Africa for the purpose of testing this hypothesis.

Gordon (R. M.) & Macdonald (G.). **The Transmission of Malaria in Sierra Leone.**—*Ann. Trop. Med. Parasit.*, xxiv, no. 1, pp. 69–80, 1 fig., 27 refs. Liverpool, 7th April 1930.

Very little is known regarding the transmission of malaria in Sierra Leone. A list is given of the species of Anophelines known to occur there, with brief records of other investigators. A study of these data shows that in no species recorded from Sierra Leone has it been shown that bred individuals develop sporozoites in the salivary glands after feeding on a suitable malaria carrier, and with only one species, *A. funestus*, Giles, have convincing feeding experiments with wild mosquitos been carried out. From the evidence obtained as a result of dissections of mosquitos found in houses, *A. gambiae*, Giles, and *A. funestus* are regarded as probable transmitters, and *A. mauritianus*, Grp., *A. pharoensis*, Theo., and *A. rhodesiensis*, Theo., are possible transmitters.

The present observations were made with bred mosquitos, the larvae of which were obtained from known breeding-places. All

adults were easily reared with the exception of *A. smithi*, Theo.; the technique used in rearing this species and in the feeding experiments is described. *A. gambiae* was found to be undoubtedly the most abundant and widely distributed Anopheline, and is essentially a house-haunting species, though a distinct seasonal variation is often observable, *A. mauritianus* and *A. squamosus*, Theo., sometimes taking its place. *A. gambiae* readily feeds on man at all hours of the day and night; the rate of salivary gland infection from 21 mosquitos caught in native huts was 9·5 per cent., and of 21 individuals fed on native crescent carriers, three (14 per cent.) became infected in the salivary glands. This species therefore fulfils all the conditions necessary to constitute it a vector of malignant tertian malaria; its distribution and feeding habits in Sierra Leone undoubtedly render it the most important transmitter of this disease. Experiments with *A. rhodesiensis* proved that this species can be successfully infected in the salivary glands as a result of feeding on a case of *Plasmodium falciparum*, but in view of its unwillingness to feed on man and the comparative rarity of houses near its breeding-places, the low infection rate previously found and the small proportion of salivary gland infections that followed successful feeding on suitable carriers, this species is not considered an important vector of malaria. Experimental proof of the susceptibility of *A. smithi* to infection with *P. falciparum*, together with a former record of the occurrence of fed females in native sleeping quarters, renders it likely that this species plays a small but very local part in the transmission of malaria in the neighbourhood of Freetown.

Duke (H. L.). **On the Susceptibility of the two Sexes of** *G. palpalis* **to Infection with** *T. gambiense* **and** *T. rhodesiense*.—*Ann. Trop. Med. Parasit.*, xxiv, no. 1, pp. 95–96, 2 refs. Liverpool, 7th April 1930.

An examination has been made of the records of transmission experiments with *Glossina palpalis*, R.-D., that were carried out at the Entebbe Laboratory during 1926–29, to determine whether there is any indication of a difference in susceptibility to infection with *Trypanosoma gambiense* and *T. rhodesiense* between the male and female flies. Of 12,737 males exposed to infection, 581 became infected, of which 178 (30·6 per cent.) had flagellates established in their salivary glands; of 11,772 females, 656 became infected, of which 183 (27·8 per cent.) showed gland infections.

Fletcher (T. B.). **Report of the Imperial Entomologist.**—*Sci. Rep. Agric. Res. Inst. Pusa, 1928–29*, pp. 74–75. Calcutta, 1930.

Culex (*Culiciomyia*) *pallidithorax*, Theo., and to a less extent *C. fatigans*, Wied., were found on the Pusa estate breeding in about 20 open wells containing drinking water. The application of small quantities of ammonia proved impracticable, owing to the hardness of the water. Experiments in attracting female mosquitos to oviposit in baits were successful, those of *C. fatigans* laying their eggs in potato decoction left in an earthen pot for one night. This bait continued to be attractive for 11 days, during which period an average of about

13 egg-masses was deposited each night in the pot, as compared with 0·3 in a pot containing well-water.

Lucilia pulchra, Wied., was successfully reared on meat; eggs were laid at the end of November, the larvae developed slowly in December and hibernated in January and the first half of February. Pupation took place in the second half of the month, and adults emerged in March.

BANERJEA (A. C.). **Some Observations on an unusual Epidemic of Malaria in the City of Lucknow (April-September 1929).**—*Ind. Med. Gaz.*, lxv, no. 3, pp. 149–153. Calcutta, March 1930.

The outbreak described was coincident with the usual benign tertian rise in Lucknow in March and April. During these months there was abnormal breeding of *Anopheles* in the river owing to the sluice gates being out of order, but after May conditions became normal and breeding ceased. During the earlier part of the epidemic, *A. culicifacies*, Giles, was breeding in the edges of the river, the unusually heavy rains probably having cleared the water sufficiently to make breeding possible. In August, after a break in the rains, much breeding of *A. stephensi*, List., occurred in domestic wells, which are very difficult of access. During April-September the Anophelines present were *A. subpictus*, Grassi, *A. fuliginosus*, Giles, *A. culicifacies* and *A. stephensi*. Dissection of numbers of each species showed that *A. stephensi* was the only one infected.

Collected Memoranda on the Subject of Malaria.—*Rec. Malaria Surv. India*, i, no. 2, vi+203 pp., 4 plans, 10 charts, 2 fldg. tables. Calcutta, Thacker, Spink & Co., 1930. Price, 16*s.* 8*d.*

This is a collection of reprints of selected papers on malaria, published in various Indian Government reports from 1847 to 1924.

GORDON (R. M.) & AIDIN (R.). **Report on Trypanosomiasis in the Cape Peninsula, together with an Account of the Prevalence of infected and uninfected Tsetse-flies in the same Area.**—*Ann. Med. Sanit. Rep. Sierra Leone 1928*, pp. 77–84, 1 map, 3 pls., 6 refs. Freetown, 1930.

Two cases of trypanosomiasis occurred in the village of Aberdeen in the Cape Peninsula, Sierra Leone, at the beginning of 1928. The partial clearing of the Peninsula has resulted in a great reduction in the total number of *Glossina palpalis*, R.-D., the number caught by one boy in one hour being reduced from 4·8 in 1922 to 2·4 in 1924, and by further clearing, to 1·9 in 1928. Unfortunately the fly is now as numerous in the completely cleared as in the partially cleared areas, though it seems probable that it migrates from uncleared land and is not actually breeding in the cleared section. A total of 209 flies was dissected, and no certain evidence of the presence of sleeping sickness trypanosomes was discovered, though infection with *Trypanosoma vivax* and *T. congolense* had increased from approximately 5 per cent. [*R.A.E.*, B, xii, 41] to more than 19 per cent. in 1928. An examination of 70 sheep and goats and of the few cattle living on the Peninsula failed to incriminate these animals as reservoirs of infection. On the other hand, it was found that the smallest number

of infected flies came from the least cleared part of the Pensinsula, a fact that suggests that game is not likely to be the main source of infection.

GOURLAY (E. S.). **Some Parasitic Hymenoptera of Economic Importance in New Zealand.**—*N.Z. J. Sci. Tech.*, xi, no. 5, pp. 339–343, 2 figs., 5 refs. Wellington, N.Z., February 1930.

The Encyrtid, *Tachinaephagus zealandicus*, Ashm., is recorded as attacking sheep blowflies in New Zealand in even greater numbers than *Mormoniella vitripennis*, Wlk., which was introduced in 1922 [*R.A.E.*, B, x, 165]. Both these species, as hyperparasites, are interfering with the work of the Braconid, *Alysia manducator*, Panz., which was introduced in 1926 [xv, 85] and is the most efficient enemy of sheep blowflies.

BEVAN (L. E. W.). **Report of the Director of Veterinary Research, Southern Rhodesia, for the Year 1929.**—Fol., 14 pp. Salisbury, Rhodesia, 1930.

Some of the cattle imported from Great Britain and inoculated against gall-sickness were found to be infested with lice or warble flies [*Hypoderma*], and as it is impossible to dip or wash inoculated animals, the reactions were seriously complicated. At one time it was suspected that the anaplasmosis was being transmitted from one animal to another by *Haematopinus eurysternus*, Nitzsch, and that the imposing of one infection upon another was the cause of the very prolonged and severe reactions, since the vaccine in uncomplicated cases produced entirely different symptoms. The louse infestation was eventually controlled by the application of derris, and with the removal of the discomfort and irritation caused by these parasites, the reactions became less severe.

Further experiments on the method of treating cattle against trypanosomiasis [*R.A.E.*, B, xvii, 171] are being carried out, but have not yet been completed.

DU TOIT (P. J.) & VILJOEN (P. R.). **Dipping as a Method of eradicating East Coast Fever.**—*15th Rep. Vet. Serv. S. Afr.*, i, pp. 33–66. Pretoria, October 1929. [Recd. 1930.]

Although dipping cattle at short intervals (3 or 5 days) for the destruction of ticks has been employed for 20 years in South Africa as the officially recognised method of controlling African coast fever, the most important vector of which is *Rhipicephalus appendiculatus*, Neum. (brown tick), the disease has not been eradicated, and many instances have occurred in which it has persisted on an infected farm for more than 15 months in spite of regular dipping.

Experiments were therefore carried out to determine the effect of various dipping treatments on the course of an outbreak on an isolated farm in the eastern Transvaal. Short-interval dipping, combined with hand-dressing of the ears, the hindquarters beneath the tail, etc., failed to arrest the progress of the disease, apparently because *R. appendiculatus* is not killed immediately by the treatment, but lives long enough to infect its host. Dipping at intervals of three days in

a solution of 1 lb. sodium arsenite (containing 80 per cent. arsenic trioxide) in 100 gals. water (*i.e.*, 0·08 per cent. arsenic trioxide) was not more effective than dipping at intervals of five days in a solution of 2 lb. sodium arsenite to 100 gals. The addition of paraffin and soap, as recommended by Pitchford [*R.A.E.*, B, ix, 84], did not increase the effectiveness of the dips. Of the preparations tested for hand-dressing, a mixture of 1 part tobacco (2 per cent. nicotine) and 10 parts mineral oil gave the best results ; this dressing may be applied with a paint brush, or any soft absorbent material tied to the end of a stick. An aqueous solution of sodium arsenite at 14-day strength (3 lb. to 100 gals.) was apparently somewhat less effective as a dressing than the tobacco and oil mixture.

From the persistence of African coast fever for more than 15 months on farms where regular dipping and hand-dressing have been carried out, it is evident that fresh ticks must become infected in the larval or nymphal stage, since infection is not hereditary in the ticks, and since they do not live or remain infective for more than 14–15 months. That it is possible for ticks to acquire infection in spite of regular treatment of the cattle is due to the practical difficulties in the way of carrying out the system in a perfect manner ; these difficulties include unfavourable climatic conditions, poor condition of the animals in the winter, and lack of fencing and proper control of the herds.

The authors conclude that the eradication of African coast fever from the Union of South Africa could be accomplished at less cost to the State by slaughtering or removing cattle from infected farms, especially in isolated outbreaks, than by short-interval dipping, although dipping has been and will continue to be of inestimable value in destroying ticks ; without it, cattle farming in South Africa would be impossible.

Bedford (G. A. H.). **The Effect upon Ticks of dipping Cattle regularly at short Intervals in Arsenical Baths.**—*15th Rep. Vet. Serv. S. Afr.*, i, pp. 551–573, 1 chart, 15 refs. Pretoria, October 1929. [Recd. 1930.]

This paper gives details of experiments in the eastern Transvaal to determine the effect of dipping at 3-day and 5-day intervals, and of various supplementary methods of treatment, on ticks infesting cattle, particularly *Rhipicephalus appendiculatus*, Neum., the chief vector of African coast fever, and other species of *Rhipicephalus*, which can also transmit the disease.

R. appendiculatus was the tick most commonly found, except in October and the early part of November, when all species were rare, but the numbers of *R. evertsi*, Neum., and *Hyalomma aegyptium impressum*, Koch, slightly exceeded those of *R. appendiculatus*. Up to the end of December, adults of *R. appendiculatus* were confined to the ears of the cattle, either inside or outside, but in January, when this species became very abundant, the number found on the ears of each animal averaging 300–400, adults were also found on the head and eyelids, and occasionally on the body and legs. With rare exceptions, the immature stages were confined to the inside of the ears, where they were deeper seated than the adults. The adults of *R. evertsi* attach themselves under the base of the tail, or occasionally on the teats or on the inside of the bases of the legs, but the larvae and nymphs

are almost confined to the inside of the ears ; this tick was prevalent from November to February, but commonest in January, when an average of 9–10 was found under the base of the tail of each animal. Adults of *R. simus*, Koch, and *R. capensis*, Koch, were occasionally found on cattle, those of the former on the brush of the tail and on the fetlocks, but never on the ears, and those of the latter on the ears. *Boophilus annulatus decoloratus*, Koch, which is a one-host tick, occurred on the bodies, necks and heads of undipped cattle, and on newly arrived cattle until they had been dipped for a week or two, but not on animals that had been dipped regularly for longer periods. Several adults and nymphs of *Margaropus winthemi*, Karsch, another one-host tick, were found on one undipped animal, and had probably been imported on cattle from the Orange Free State. Adults of *H. aegyptium impressum* were found under the base of the tail, and occasionally on other parts ; the immature stages infest hares and other small mammals and birds. *Amblyomma hebraeum*, Koch, was found chiefly on newly imported cattle, but was not common ; the adults attach themselves to the hindquarters beneath the tail, at the bases of the legs, on the abdomen, etc.

The sodium arsenite dip, both at 3-day and 5-day strengths [see preceding paper], Pitchford's laboratory dip at 5-day strength [*R.A.E.*, B, ix, 84], a dip consisting of 8 lb. copper sulphate, 2 lb. arsenic trioxide and 1·6 pints hydrochloric acid in 100 gals. water, and a proprietary dip containing 0·16 per cent. arsenic trioxide, all killed a very large percentage of adults of *R. evertsi* and *H. aegyptium impressum* under the bases of the tails, the 5-day sodium arsenite dip being almost or quite as good without any additional chemicals as with them. In most of the experiments to compare the dips, the fluids were sprayed on to the animal, as this method was cheaper and equally reliable. The sodium arsenite dips were less effective in killing adults and immature stages of *R. appendiculatus* and other species of *Rhipicephalus* on the heads and in the ears, although all the cattle observed to plunge into the dipping tanks immersed their heads completely in the fluid, so that the ears should have been completely wetted at each dipping. Immature stages that had survived dipping and had engorged inside the ears were in some cases observed to moult in due course. Of adults of *R. appendiculatus* that were attached to the ears of cattle dipped in 5-day sodium arsenite dip, 52 per cent. died within 24 hours, 79 per cent. in two days and 90 per cent. in three days. Of adults of *R. evertsi* attached beneath the bases of the tails of cattle sprayed with the same dip, 95 per cent. died within 24 hours. Clipping the fringes of the ears did not appear to render the dips more effective, but clipping the brush of the tail kept it free from infestation by *R. simus* and other ticks.

The dips killed a very large percentage, not only of the ticks that were attached when the cattle were dipped, but also of those that became attached up to 48 hours after dipping, although dipping did not prevent ticks from attaching themselves. Further, females that lived long enough on dipped animals to engorge mostly died a few days after leaving their host, without ovipositing, or else laid a few eggs that failed to hatch ; only very rarely did they lay viable eggs.

Regular dipping of stock should be carried out every five days on farms infected with African coast fever, and every 5–7 days on non-infected farms. Dipping cannot be relied upon to kill adult ticks within three days, the time required for a tick to infect its host, but

most of the adults of *R. appendiculatus* attach themselves to the ears, where they can speedily be destroyed by hand-dressing, as can the adults of *R. evertsi* beneath the base of the tail. Hand-dressing of the ears, both inside and outside, eyelids, etc., is essential where African coast fever is present, but on farms free from infection, unless adult ticks are numerous and engorged females are observed, it may be confined to the inside of the ears. This treatment at 3-day intervals destroys the larvae and nymphs of *R. appendiculatus* and *R. evertsi* in the ears, and if these stages occur on other parts of the body, regular dipping every five days can be relied upon to kill them ; animals that cannot be dipped should be sprayed with a hand pump. Dipping every 5-7 days in sodium arsenite at 5-day strength is recommended against *A. hebraeum*, instead of every 14 days in a dip containing 0·24 per cent. arsenic trioxide, as has sometimes been advocated ; an interval of 14 days is too long, on account of the short time that the ticks remain upon their host. *B. annulatus decoloratus* and *M. winthemi* should not be found on animals that have been dipped at intervals of three, five or seven days for two weeks.

BEDFORD (G. A. H.). **Anoplura (Siphunculata and Mallophaga) from South African Hosts.**—*15th Rep. Vet. Serv. S. Afr.*, i, pp. 501–549, 34 figs. Pretoria, October 1929. [Recd. 1930.]

The lice from mammals and birds described and recorded in this paper were mostly collected in South-west Africa, but some from other parts of South Africa are included.

An immature individual of *Linognathus vituli*, L., is recorded as being found attached to *Musca interrupta*, Wlk. (*lasiophthalma*, Thoms.) at Capetown. As the result of the examination of specimens from various ducks and geese in South Africa, the author concludes that *Menopon africanum*, Kellogg & Paine, which was originally described from a goose in the Sudan, is a synonym of *M. tumidum*, Piaget. *Numidicola* (*Menopon*) *antennata*, Kellogg & Paine, *Goniodes numidae*, Mjöb., *Goniocotes gallinae*, Retz., and *G. gigas*, Tasch., are recorded from guinea-fowl in South-west Africa. Several new genera are erected, including *Bovidoecus*, for *Trichodectes bovis*, L. (the type), *T. caprae*, Gurlt, *T. limbatus*, Gerv., *T. ovis*, L., *T. equi*, L., and several other species, and *Felicinia*, for *T. subrostratus*, Nitzsch (the type), and seven other species.*

NEAVE (S.A.). **A Summary of Data relating to Economic Entomology in the British Empire.**—Med. 8vo, 23+2 pp. London, Imp. Bur. Entom., 1930. Price, 2*s.* 6*d.*

In this paper, which was prepared for the Third Imperial Entomological Conference, an attempt is made to summarise the expenditure incurred by entomological departments in the British Empire. It is pointed out that the United States, with a population of some 106,000,000, spends at least £2,000,000 a year and employs not less than 500 entomologists, while the British Empire, with a population more than four times as numerous, spends little more than one-fourth

*[A book by Ewing already noticed [*R.A.E.*, B, xvii, 202] has priority over this paper, and contains the new genera *Felicola*, with which *Felicinia* is isogenotypic, and *Bovicola* (type *caprae*, Gurlt), which includes *T. bovis* and *T. ovis*, but not *T. equi*.—ED.]

of this and employs less than 300 entomologists. If the expenditure on entomology in relation to total revenue were on the same basis as in the United States, it is shown that the British Empire would be spending nearly seven times as much as it actually does. Thus it is open to question whether the Empire is bearing its share in the fight between man and insects. The contrast is greater when the dissimilarity of conditions is considered, as the problems of the United States, though on a vast scale, are limited in variety, and neglect of them would not be specially dangerous to the rest of the world, whereas the responsibility of an Empire scattered throughout the world and concerned with a greater range of pests and crops is a much heavier one.

Pijper (A.) & Dau (H.). **The Aetiology of Tick-bite Fever.** — *J. Trop. Med. Hyg.*, xxxiii, no. 7, pp. 93–94, 1 pl., 10 refs. London, 1st April 1930.

Tick-bite fever occurs in many parts of South Africa. Its clinical features are very similar to those of typhus, Rocky Mountain spotted fever and particularly pseudotyphus, but it is never fatal. The authors observed bodies resembling *Rickettsia* in blood-smears from patients and from experimentally infected guineapigs ; the presence of large numbers of these bodies in " nodules " in the brain of a guinea-pig inoculated 18 days previously with blood from a patient at the height of fever enabled their identification as *Rickettsia* to be established. It is concluded that they are the causal agent of the disease.

Lorando (N. T.). **A Biological Method for destroying Bedbugs.**—*Sci. Mon.*, xxix, no. 3, pp. 265–268. New York, 1929. (Abstract in *Expt. Sta. Rec.*, lxii, no. 3, p. 246. Washington, D.C., February 1930.)

In Greece, a spider, *Thanatos flavidus*, Simon, was observed preying on bedbugs [*Cimex*]. It destroyed 30–40 individuals in a day, according to their size and the quantity of blood they contained. The young spiders hatch after an incubation period of 18 days in summer, and attack the bugs immediately.

Downham (K. D.). **Some external Parasites of Swine.**—*Pig Breeders' Annual*, ix (1929–30), pp. 67–69. London [1930].

The information contained in this paper is almost identical with that already noticed from another source [*R.A.E.*, B, viii, 200]. It is recommended that the ears of pigs infested with *Haematopinus suis* var. *adventicius*, Neum., should be treated with a mixture of 2 parts pine tar to 1 part cotton-seed oil.

Reports of the Mosquito Control Committee of the Ottawa District, 1927, 1928 & 1929.—10 pp. multigraph, 13 pls., 1 map ; 12 pp., 3 figs. ; 15 pp., 3 figs. Ottawa, 1928–1930.

These three reports contain detailed accounts, by C. R. Twinn, of the work carried out in the control of mosquitos around Ottawa in 1927–29, together with financial statements. A mosquito survey of the area and brief summaries of the work done in 1927 and 1928 have already been noticed [*R.A.E.*, xiv, 126 ; xvii, 138, 245]. In 1929,

as in 1928, the Ottawa river rose to an abnormal height in the early spring, and large areas of low-lying land were flooded, resulting in the hatching of enormous numbers of larvae of the flood-water mosquito, *Aëdes hirsuleron*, Theo. [not *A. vexans*, Mg., as erroneously stated in a previous abstract, xvii, 245]. The flooded areas were effectively oiled, however, by means of boats, and comparatively few adult mosquitos appeared. The rain-pool mosquito, *A. vexans*, was much less troublesome than in 1928, because the summer was warm and dry, and there was little surface water. Mosquitos occurring during the period under review that were not recorded in the survey [xiv, 126] were *Anopheles punctipennis*, Say, which was found breeding in drying stream beds, *Aëdes dorsalis*, Mg., and *Theobaldia dyari*, Coq.

Mense (C.) and others. **Handbuch der Tropenkrankheiten.**—3rd edn., vol. v, part 2, imp. 8vo, pp. viii, 847–1418, 3 pls., 194 figs., refs. Leipzig, J. A. Barth, 1930. Price, paper, *M.*70, bound, *M.*74.

This part [*cf. R.A.E.*, B, xvii, 134] includes sections on the blood-flagellates, especially trypanosomes, and blood-cell parasites of vertebrates. As vectors of sleeping sickness, *Glossina palpalis*, R.-D., *G. morsitans*, Westw., and *G. swynnertoni*, Aust., are specifically dealt with, and information on their distribution, biology and importance is given.

The extensive and useful bibliographies are not claimed to be complete.

Colas-Belcour (J.). **Sur l'identité d'***Ornithodorus erraticus* **Lucas et d'***O. marocanus* **Vélu.**—*Arch. Inst. Pasteur Tunis*, xix, no. 1, pp. 1–12, 4 figs., 16 refs. Tunis, February 1930.

A summary of this paper has been noticed from another source [*R.A.E.*, B, xviii, 62]. A key to the species of *Ornithodorus* known to occur in Tunisia is included.

Delanoë (P.). **Les spirochètes des ornithodores des terriers et le spirochète de Mansouria appartiennent bien à l'espèce** *Sp. hispanicum* **v.** *marocanum* **Ch. Nicolle et Ch. Anderson 1928.**—*Arch. Inst. Pasteur Tunis*, xix, no. 1, pp. 16–26, 2 charts, 1 ref. Tunis, February 1930.

The author has discovered that the observations on which he based his statement that the Doukkala and Mansouria strains of *Spirochaeta hispanica* var. *marocana* produce a non-recurrent infection in man [*R.A.E.*, B, xvii, 226; xviii, 105] were incorrect, and as the result of further experiments he concludes that all the spirochaetes so far studied in Morocco, other than *S. recurrentis*, belong to a single species. A human subject inoculated with blood from a guineapig infected with a strain of *S. hispanica* var. *marocana* from *Ornithodorus* [*erraticus*, Lucas] from a porcupine burrow in the Doukkala region developed a typical recurrent infection, lasting about seven weeks; the fever was so mild, however, that the relapses would have passed unnoticed but for the temperature records. The author himself developed relapsing fever as the result of being bitten by two unfed larvae of *O. erraticus*, hatched from eggs laid by females infected with the Mansouria strain of *S. hispanica* var. *marocana*. The onset of the

fever occurred in ten days, and by that time the bites of the ticks on the forearm were unrecognisable; this suggests that the reason why Hornus was unable to find evidence of tick bites on patients suffering from relapsing fever [xvii, 146] was that infection had been caused by larvae.

Investigation in five porcupine burrows in a part of the Doukkala region not previously visited showed that *O. erraticus* was present in each. The ticks in three out of four of these burrows were infected with *S. hispanica* var. *marocana*. In one burrow, in which the soil had become very dry, there were hundreds of dead adults of *O. erraticus*, but only nine living ones, showing that the adults do not readily leave the burrows of their hosts, even when conditions become unfavourable. The larvae and nymphs, however, which are unable to survive for long periods without feeding, travel freely, and this may account for the infection of persons who are not known to have come into contact with the ticks. That infection in man is not more frequent may be because not all the larvae are infective and because they are usually able to engorge without leaving the burrows of their hosts. The absence of records of relapsing fever in the Doukkala region is probably due to the disease being so mild in the natives that the relapses pass unnoticed.

Schuurman (C. J.) & Schuurman-Ten Bokkel Huinink (A. M.). **Bird Malaria.**—*Meded. Dienst Volksgezondh. Ned.-Indië*, Foreign edn., xviii, no. 3, pp. 469–497, 1 pl., 44 refs. Batavia, 1929.

A brief history of bird malaria is given, with an account of observations on its occurrence in Batavia in various birds. The morphological characters of the parasite, *Plasmodium praecox*, are described, and the natural occurrence of cysts, probably of this parasite, in the stomach of two individuals of *Culex fatigans*, Wied., is recorded, this mosquito having been found to carry the disease under laboratory conditions. Methods of breeding it and also *Aëdes argenteus*, Poir., in the laboratory are described.

Haga (J.). **Tabellen voor determinatie der in Nederlandsch-Oost-Indië voorkomende Anophelinen.** [Keys to the Anophelines of the Dutch East Indies.]—*Geneesk. Tijdschr. Ned-Indië*, lxx, no. 4, pp. 363–382. Weltevreden, 1st April 1930.

These keys to the males, females and larvae of the Anophelines of the Dutch East Indies are intended to replace those by Swellengrebel (1921) and Rodenwalt (1924) [*R.A.E.*, B, ix, 216; xiii, 131]. The nomenclature of the species is brought into line with recent practice.

Papers noticed by Title only.

A List of the Entomologists employed in the British Empire.—Med. 8vo, 16 pp. London, Imp. Bur. Entom., 1930. Price, 2*s.* 6*d.*

Ferris (G. F.). **Some New World Hippoboscidae (Diptera Pupipara).**—*Canad. Ent.*, lxii, no. 3, pp. 62-70, 5 figs. Orillia, March 1930.

Jones (R. M.). **Some Effects of Temperature and Humidity as Factors in the Biology of the Bedbug** (*Cimex lectularius* **Linn.).**—*Ann. Ent. Soc. Amer.*, xxiii, no. 1, pp. 105–119, 7 refs. Columbus, Ohio, March 1930.

Talice (R. V.). **Etude histologique de la piqûre de** *Dermacentor reticulatus* **(Fabricius, 1794).**—*Ann. Paras. hum. comp.*, viii, no. 2, pp. 173–178, 1 pl., 6 figs., 5 refs. Paris, 1st March 1930.

Nicolle (C.), Anderson (C.) & Colas-Belcour (J.). **Sur le rôle d'***Ornithodorus erraticus* **dans la transmission naturelle de deux groupes de spirochètes récurrents. Danger de la propagation de la fièvre récurrente hispano-marocaine à l'Algérie et à Tunisie.**—*Arch. Inst. Pasteur Tunis*, xix, no. 1, pp. 14–15, 4 refs. Tunis, February 1930. [See *R.A.E.*, B, xviii, 62.]

Nicolle (C.) & Anderson (C.). **Les spirochètes récurrents marocains transmis par** *Ornithodorus erraticus* (*Orn. marocanus*) **appartiennent à un seul groupe** *Sp. hispanicum* **non divisible en espèces.**—*Arch. Inst. Pasteur Tunis*, xix, no. 1, pp. 27–35, 2 charts, 2 refs. Tunis, February 1930. [*Cf. R.A.E.*, B, xviii, 19.]

Walch (E. W.). **The Larva of** *Anopheles pedilaeniatus* **(Leicester).**—*Meded. Dienst Volksgezondh. Ned.-Ind.*, Foreign edn., xix, pt. 1, pp. 44–45, 1 pl. Batavia, 1930.

Efflatoun (H. C.). **A Monograph of Egyptian Diptera. Part III. Family Tabanidae.** *Mém. Soc. ent. Egypte*, iv, fasc. 1, pp. 1–114, 2 pls., 128 figs. Cairo, 1930.

Bedford (G. A. H.). **Notes on some South African Ticks, with Descriptions of three new Species** [from Rodents].—*15th Rep. Vet. Serv. S. Afr.*, i, pp. 493–499, 5 figs. Pretoria, October 1929. [Recd. 1930.]

Poisson (R.). **Sur un** *Herpetomonas* [*familiaris savatilis*, n.] **parasite de** *Spilostethus* (*Lygaeus*) *savatilis* **(Scop.) (Hémiptères Lygaeidae). A propos des phytoflagelloses.** *C. R. Soc. Biol.*, ciii, no. 13, pp. 1057–1061, 5 figs., 16 refs. Paris, 4th April 1930.

Poisson (R.). *Herpetomonas tortum* **n. sp., parasite intestinal des** *Camptopus lateralis* **(Germ.) (Hémiptères Coreidae, Alydaria) des environs de Banyuls. Rôle possible de cet insecte comme agent transmetteur de phytoflagellose.** *C. R. Soc. Biol.*, ciii, no. 13, pp. 1061–1064, 16 figs., 8 refs. Paris, 4th April 1930.

Wigglesworth (V. B.). **The Formation of the Peritrophic Membrane in Insects, with special Reference to the Larvae of Mosquitoes.**—*Quart. J. Micros. Sci.*, lxxiii, pt. 4, pp. 593–616, 10 figs., 36 refs. London, May 1930.

Tegoni (G.) & Williams (B.). **Indice bibliografico della malaria.** [Index to the Literature on Malaria.] **III. 1928.**—*Riv. Malariologia*, ix, Suppl., 114 pp. Rome, 1930. [*Cf. R.A.E.*, B, xvii, 168.]

Lima (A. da Costa). **Sobre a revalidação do genero** *Taeniorhynchus* **F. Lch. A. (Diptera ; Culicidae).** [The Validity of the Genus *Taeniorhynchus*, F. Lch. Arrib.]—*Mem. Inst. Oswaldo Cruz*, xxiii, no. 2, pp. 105–108, 4 refs. Rio de Janeiro, 1930.

Walch (E. W.) & Soesilo (R.). **A comparative Study of the Pecten of the Netherlands Indies** *Anopheles*-**Larvae, preceded by some other morphological Observations.**—*Meded. Dienst Volksgezondh. Ned.-Indië*, Foreign edn., xviii, no. 3, pp. 453–468, 2 pls. Batavia, 1929.

Constantineanu (M. J.). **Der Aufbau der Sehorgane bei den im Süsswasser lebenden Dipterenlarven und bei Puppen und Imagines von** *Culex*. [The Structure of the Visual Organs in Dipterous Larvae inhabiting Fresh Water and in the Pupae and Adults of *Culex*.]—*Zool. Jahrb.*, Abt. Anat., lii, no. 2, pp. 253–346, 12 pls., 25 figs., 29 refs. Jena, 3rd June 1930.

Walch (E. W.) & Schuurman (C. J.). **Saltwater Fishponds and Malaria.**—*Meded. Dienst Volksgezondh. Ned.-Indië*, Foreign edn., xviii, no. 3, pp. 341–366, 8 pls. Batavia, 1929. Also as: **Zoutwatervischvijvers en Malaria.**—*Geneesk. Tijdschr. Ned-Indië*, lxx, pt. 3, pp. 209–234, 8 pls. Weltevreden, 1930.

Fishponds are an important source of food in the Dutch East Indies, and the literature dealing with them in relation to the breeding of malaria mosquitos is briefly reviewed. The vegetation that reaches the surface, consisting chiefly of green algae that form a more or less stringy mass upon the water, as well as other water-plants, protects the Anopheline larvae from the fish, *Haplochilus panchax*. Where it occurs in open water in sufficient numbers, no Anopheline larvae can be found.

Dusting with Paris green is possible, since the arsenic percentage in the fish is not increased thereby, but it should be undertaken only where it is impossible to prevent the growth of green algae on the surface. The best method of preventing the development of algae of this type is to make the ponds deeper along the banks, and the centre higher than the water-level in the channel (with which the pond communicates with the sea through sluices) during ebb at springtide, so that it is always possible to drain the water from the pond at such times. When the pond is emptied, the central portion is laid dry, and the green algae that are stranded there are reduced by the sun to a dry powder in 2 or 3 days. A shallow layer of water is then allowed to cover the centre, in order to encourage the formation of blue algae (Cyanophyceae) and diatoms, on which the fish feed. These continue to develop on the bottom after the pond is refilled. The fish that retire to the circular ditch that is left when the pond is emptied devour the relatively small quantity of green algae there.

Tanaka (K.), Kaiwa (J.), Teramura (S.) & Kagaya (J.). **Beiträge zur japanischen Kedani-Krankheit.** [Contributions on Japanese Kedani Disease.]—*Zbl. Bakt.* (1, Orig.), cxvi, no. 6-8, pp. 353–385, 8 pls., 35 refs. Jena, May 1930.

Kedani (tsutsugamushi) disease is known only from Japan. The mite that carries it only occurs at certain seasons, and is restricted to certain areas on the rivers. In these areas the field-mice harbour four different species of mites, the chief external characters of which are described in minute detail. The names used for these by the authors are *Trombicula* (*Kedania*) *tanakai*, K. Kishida (1909) (*akamushi*, Brumpt (1910)); *T. pseudoakamushi*, Tanaka A. (*pallida*, Nagayo et al. 1919); *T. pseudoakamushi*, B. (*palpalis*, Nagayo et al. 1919); and *T. autumnalis japonica*. The hypopharynx or proboscis is discussed in connection with the mechanism of sucking, with notes on the internal organs of the mites.

Niño (F. L.). **Contribución al estudio de la enfermedad de Chagas o tripanosomiasis americana en la República Argentina.** [A Contribution to the Study of Chagas' Disease or American Trypanosomiasis in Argentina.]—*Univ. B. Aires Fac. Cienc. méd.* (*Tesis*), 1928, no 4392, xvi + 239 pp., 8 pls., 54 figs., 9 graphs, 147 refs. Buenos Aires, 1929.

This paper on Chagas' disease deals with its history; causal agent, *Trypanosoma* (*Schizotrypanum*) *cruzi*; intermediate hosts; clinical

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forms ; geographical distribution, epidemiology, prophylaxis, etc. The chief intermediate host in Argentina is the Reduviid bug, *Triatoma infestans*, Klug [*cf. R.A.E.*, B, xvi, 80]. Experiments proved that the infection is not inherited in this bug.

Stiles (C. W.) & Collins (B. J.). *Ctenocephalides*, **new Genus of Fleas, Type** *Pulex canis*.—*Publ. Hlth. Rep.*, xlv, no. 23, pp. 1308–1310. Washington [D.C.], 6th June 1930.

A new generic name, *Ctenocephalides*, is proposed for *Ctenocephalus*, Kolen., which is preoccupied in Trilobites. The type of the genus is designated as *canis*, Curt. (*novemdentatus*, Kol.), and its scope is discussed, *C. felis*, Bch., and other less well known fleas being included in it.

Neiva (A.) & Gómez (J. F.). **El gusano del Monte** (*Dermatobia*). —*Rev. Agric. Puerto Rico*, xxiv, no. 9, pp. 99–106, 123. S. Juan, P.R., March 1930.

This paper is a résumé of the authors' observations, which have been carried out in S. Paulo, Brazil, since 1917, on the oviposition and egg-disposal of *Dermatobia hominis*, Say, which occurs from Mexico to Argentina. The eggs are laid on mosquitos and other Diptera, whence the resulting larvae are transferred to the skin of man and animals.

Schwetz (J.). **Le problème des glossines et des trypanosomiases animales dans la région du lac Kivu. (Note préliminaire.)**—*Ann. Soc. belge Méd. trop.*, ix, no. 4, pp. 391–402. Brussels, 31st December 1929.

This is an account of investigations made from December 1927 to February 1928 in the environs of the Lake Kivu, Belgian Congo, whence reports of periodical outbreaks of trypanosomiasis among herds of cattle have been received. As no tsetse-flies were found either in the immediate vicinity of the lake or on the surrounding high plateaux, it is concluded that the disease must have been imported, the infected animals having passed through localities where tsetse-flies are present. The distribution of *G. palpalis*, R.-D., *G. fusca*, Wlk., and *G. pallidipes*, Aust., in adjoining districts is briefly discussed. As the presence of *Glossina* is indispensable for the maintenance of the disease in endemic form, any outbreak of imported trypanosomiasis becomes sooner or later extinct, though mechanical transmission of the disease may occur owing to the presence of such blood-sucking flies as *Stomoxys* and *Haematopota* or other Tabanids.

[Simić (Č.)]. Simic (T.). **Etude comparative de la biologie de** *Phlebotomus perniciosus* **et** *Phlebotomus papatasi* **en Macédoine.**— *Ann. Paras. hum. comp.*, viii, no. 2, pp. 179–182. Paris, 1st March 1930.

Further details are given of the biology of *Phlebotomus major* var. *perniciosus*, Newst., and *P. papatasii*, Scop., in Southern Serbia [*R.A.E.*, B, xviii, 113]. The former is abundant, being at its maximum in July and August ; at the beginning of September it becomes rare and disappears before the end of the month. It is not often found in

the centre of Skoplje, and is therefore probably of little importance in the transmission of sandfly fever. During the day it shelters in outhouses and dark places, such as under the floorboards of a verandah, and enters dwellings at night, to which it is attracted by lights.

P. papatasii is the most widespread and abundant species in Macedonia, especially to the south of Skoplje, its northern limit being the old Serbo-Turkish frontier. It is essentially a domestic species, and is found hiding during the day in bedrooms, both sexes occurring in about equal numbers. In dark rooms, it bites during the day as well as all night, and it is not particularly attracted to light. It only leaves the house for oviposition, after which it may enter a different one, thus causing the spread of sandfly fever from house to house. *P. papatasii* generally appears about the middle of May, is at its height in July and August and decreases rapidly in September; it may be considered virtually the only vector of sandfly fever.

CHAMBERLAIN (W. P.) & CURRY (D. P.). **Mosquito and Malaria Control Work.** - *Rep. Hlth. Dept. Panama Canal, 1928*, pp. 25–33. Balboa Heights, C.Z., 1930.

Drainage operations were continued and extended in the Panama Canal Zone during 1928 [*cf. R.A.E.*, B, xvii, 162], the largest single installation of open-earth ditches being on Galeta Island, where some 30,000 feet of sea-level ditches were dug through mangrove swamps that are covered by high tides to a depth of 6 in.–1 ft. During the time of maximum precipitation in the rainy season, the sea water in the swamps was able to become sufficiently diluted to permit most intensive breeding of *Anopheles tarsimaculatus*, Goeldi, which was found more abundantly throughout the Island than it had been in the Isthmus for some years. The drainage operations, which are described, now admit a quick drawing-off of storm water, however heavy the rainfall, and have resulted in practically complete control of mosquito breeding. It is believed, moreover, that these swamps were the sole source of mosquito flights into the neighbouring military posts and the city of Colon, more than two miles away, where *Culex nigripalpus*, Theo., and *C. psatharus*, Dyar, also appeared, probably from the same source. New San Francisco, which was formerly invaded by *Aëdes taeniorhynchus*, Wied., and *Anopheles albimanus*, Wied., from neighbouring swamps, has also been cleared by drainage, and although two years ago the village was highly malarious, there is now little or no disease among the residents.

A recent discovery in the Canal Zone is the presence of *Anopheles* (*Nyssorhynchus*) *bachmanni*, Petrocchi. It is found only in the crowns of water lettuce (*Pistia stratiotes*) growing in Gatun Lake. This species is considered a dangerous malaria carrier, but the poison sprays used against water hyacinths also destroy this plant, and large areas of the lake are freed by this means from what would otherwise be a dangerous source of malaria. On another lake, this species, which had probably been mistaken for *Anopheles albimanus* in the past, was controlled by spraying the floating beds of water lettuce with fuel oil. *A. evansi*, Brèthes (of which *A. strodei*, Root, is treated as a synonym) is also prevalent on the Isthmus and has probably been mistaken for *A. tarsimaculatus*.

Faust (E. C.). **Migration Route of** *Spirocerca sanguinolenta* **in its Definitive Host.** –*Proc. Soc. Exp. Biol. Med.*, xxv, p. 192. New York, 1927. **The Life Cycle of** *Spirocerca sanguinolenta*, **a natural Nematode Parasite of the Dog.**—*Science*, lxviii, pp. 407–409. New York, October 1928. (Abstract in *Bull. Inst. Pasteur*, xxviii, no. 5, p. 238. Paris, 15th March 1930.)

By feeding a dog on spiruroid larvae encysted in oriental cockroaches [*Blatta orientalis*, L.], Grassi obtained an infestation of the intestinal and stomach walls attributed by him to *Spirocerca sanguinolenta*. The author has found that the larvae of *Spirocerca* pass directly through the walls of the stomach in order to establish themselves in the aorta, which does not correspond to the evolution as recorded by Grassi. Moreover, no larvae of *S. sanguinolenta* were present in hundreds of cockroaches taken in China in foci of spirocercal infestation and examined by the author. Nor did any cockroaches of various species, fed on the eggs of this Nematode, become infested. It seems, therefore, that these insects are not the intermediary hosts of *S. sanguinolenta*.

On the other hand, coprophagous Coleoptera of the genus *Canthon* collected in a district where hedgehogs were heavily parasitised by *S. sanguinolenta* harboured larvae of the Nematode in their thoracic muscles, which, fed to a young dog, produced a typical infestation of the aorta. The author thinks, therefore, that, at least in northern China, beetles of the genus *Canthon* are the first intermediate hosts of *S. sanguinolenta*, while hedgehogs and other insectivorous animals are second intermediate or transitory hosts. The dog is the true definitive host.

[Investigations on Malaria and its Control.]—*Ann. Rep. Dept. Hlth. Palestine, 1928*, pp. 28–35 & 92–99. Jerusalem, 1929.

An account is given of the work against mosquitos and malaria in Palestine during 1928, which included field surveys of mosquito breeding-areas, the organisation of drainage work, etc.

In order to prevent the development of *Anopheles bifurcatus*, L., which is an urban species [*R.A.E.*, B, xiv, 56, 127], rain-water cisterns in towns and hill-villages have been fitted with suitable doors and pumps to replace the bucket and rope method of drawing water. In rural districts the use of Paris green as a larvicide has been greatly extended, and has proved effective against *A. sacharovi*, Favr (*elutus*, Edw.) in swamps and stagnant pools, as well as against *A. superpictus*, Grassi, and *A. sergenti*, Theo., in streams. The antilarval control work in the swamps was possible and successful owing to the low average rainfall. There were no marked epidemics in the controlled areas, and no great increase of adults at any time during the season. In January and February larvae of *A. hyrcanus*, Pall., *A. algeriensis*, Theo., and *A. sergenti* occurred in water at temperatures varying from 10 to 18° C. [50–64·4° F.], and *A. sergenti* was found in a canal, the water temperature of which was 20° C. [68° F.]. *A. pharoensis*, Theo., occurred in Upper Galilee during September, October and November, and one female of *A. mauritianus*, Grp., which has not been observed in Palestine for the last 10 years, was caught in June. *A. superpictus* was abundant from June to September and *A. sergenti* between July and September. *A. sacharovi* occurred in one locality in October and December, although not a single larva of this species was found

in the locality. The same phenomenon was observed in Judaea in November–December, the adults having originated 2–4 miles away [*cf.* xvii, 156].

The drainage work, with estimates of cost, is discussed.

REITLER (R.). **Ueber die Rolle der Imaginesbekämpfung in der Malariaverhütung.** [The Rôle of Measures against Adult Mosquitos in the Prevention of Malaria.]—*Arch. Schiffs- u. Tropenhyg.*, xxxiv, no. 4, pp. 198–210, 4 figs., 1 ref. Leipzig, April 1930.

An account is given of malaria control work during the construction of an electric power station at the junction of the Yarmuk and Jordan rivers.

The mosquitos found were *Anopheles sacharovi*, Favr (*elutus*, Edw.), which breeds in still water, and *A. superpictus*, Grassi, and *A. sergenti*, Theo., both of which prefer slow-flowing water. *A. sacharovi* and *A. superpictus* are most numerous in early summer and in autumn, and *A. sergenti* in early autumn. At midsummer there is a marked decrease in breeding, and in winter it ceases almost completely. Measures against the larvae, within a radius of three miles, consisted of dusting with Paris green, oiling, etc. Control of the adults by collecting them was partly based on the fact that *A. superpictus* and *A. sergenti* seek shelter preferably in dark woollen garments that have been worn. These were placed in each house in a draught-free corner of the porch, which was screened with gauze. To trap individuals seeking winter quarters, the garments were hung in wooden huts and cellars, all doors and cupboards being left open. Collection was done with test-tubes wetted inside with kerosene, to which the mosquitos adhered. The weekly catches from June 1928 to August 1929 are recorded in a table. *A. sacharovi* was not taken. Very few mosquitos were caught inside screened houses, and the numbers were higher in the traps than in the unscreened houses, about 65 per cent. of the catches being made in the former. These results show the value of proper screening and confirm those obtained by Hanafin [*R.A.E.*, B, xvi, 246]. In autumn, up to mid-November, 1928, about 20 per cent. of the mosquitos were taken in the porches, as compared with 75 per cent. in the following spring and summer, only a few individuals being obtained there during the winter. It would seem, therefore, that many of the so-called "house mosquitos" live outside human dwellings during the warm season and seek such dwellings for permanent residence only during the hibernation period. This fact is of importance where the daily destruction of adults is carried out. It is considered that the prevalence of malaria was reduced to one-fifth by the measures taken against the adults.

DURAND (P.) & CONSEIL (E.). **Transmission expérimentale de la fièvre boutonneuse par** *Rhipicephalus sanguineus*.—*C. R. Acad. Sci. Fr.*, cxc, no. 21, pp. 1244–1246. Paris, 1930.

By the inoculation of healthy persons with the crushed bodies of *Rhipicephalus sanguineus*, Latr., obtained from a dog that was associated with a case of Marseilles fever [*R.A.E.*, B, xvii, 253], the characteristic symptoms were produced in two days. It is therefore concluded that this species is a vector of the disease.

Bennbrook (E. L.). **El paludismo en el estado Bolivar.** [Malaria in the State of Bolivar, Venezuela.]—*Cultura Venezolana*, xii, no. 98 reprint 8 pp., 4 refs. (With a Summary in English.) Caracas, October 1929.

In May and June 1929, at the beginning of the rainy season, a malaria survey, made in certain towns in the State of Bolivar, Venezuela, showed that the Anophelines present were *Anopheles tarsimaculatus*, Goeldi, *A. albitarsis*, Arrib., *A. argyritarsis*, R.-D., *A. pseudopunctipennis*, Theo., and *A. apicimacula*, D. & K.

Maslow (A. W.). **Die neuen Ergebnisse von der geographischen Verbreitung der Mücke** *Anopheles bifurcatus*, **L.** [New Studies of the Geographical Distribution of *A. bifurcatus*.]—*Zool. Anz.*, lxxxix, no. 3–4, pp. 95–96. Leipzig, 1st June 1930.

Anopheles bifurcatus, L., is recorded from several localities in the Tomsk government; this is stated to be the first record of this species from western Siberia [but *cf. R.A.E.*, B, xv, 22].

Report of the Third Imperial Entomological Conference 17-27th June 1930.—Med. 8vo, 59 pp. London, The Imperial Institute of Entomology, 1930. Price 2*s.* net.

At this Conference, which was attended by 37 delegates, an announcement was made that the Imperial Bureau of Entomology will in future be known as the Imperial Institute of Entomology. Among the more important resolutions passed at the Conference was one to the effect that there should be an appreciable increase in the annual contributions placed at the disposal of the Managing Committee, if the present standard of efficiency of the Institute is to be maintained, in order that it may be in a position to cope with the increase in work and responsibility that falls upon it. The Conference also emphasised the necessity in the interests of continuity in the entomological work in the British Empire of means being devised to place the Institute on an assured and permanent basis.

Appendices contain details of the work of the Institute from April 1925 to March 1930 and of its organisation and estimated annual expenditure. Summaries are given of the discussions at the scientific meetings of the Conference, the subjects dealt with being:—The Organisation of Entomological Departments; Entomological Work among Backward Races; Tsetse Control; the Control of Insects by Cultural Methods; Locusts; The Biological Control of Insects; The Control of Weeds by Insects; and The Control of Orchard Pests.

Proclamations under the Quarantine Act 1908-1924 in force on the 31st December 1929.—24 pp. Melbourne, Department of Health [1930].

This is an abstract of the Australian proclamations and quarantines in force that deal with diseases and pests of man, animals and plants.

ELTRINGHAM (H.). **Histological and illustrative Methods for Entomologists.**—Cr. 8vo, xii+139 pp., 1 pl., 18 figs. Oxford, The Clarendon Press; London, Humphrey Milford, 1930. Price 7*s.* 6*d.* net.

This useful book is primarily intended as a guide for those who have not received a laboratory training. In the first part, the more elementary methods used in the study of the anatomy and histology of insects are described, chapters being devoted to the apparatus and materials needed, preparations of genitalia, section-cutting and staining. The remainder deals with the making of drawings and models and the colouring of lantern slides and photographs, and includes a chapter by H. Britten on making preparations of small entire insects.

The author states that he has himself repeatedly used the majority of the processes described, with successful results.

WEBER (G. A.). **The Bureau of Entomology, its History, Activities and Organisation.**—*Service Monog. U.S. Govt.*, no. 60, xii+177 pp. Washington, The Brookings Institution, 1930. Price $1.50.

This is one of a series of monographs, prepared by the Institute for Government Research, giving a detailed description of each of the service departments of the Government of the United States. The history, activities and organisation of the Bureau of Entomology are fully described. The publications of the Bureau, the laws governing its operations, its financial undertakings, and a bibliography of the literature dealing with its activities are given in appendices.

CAMPBELL (F. L.). **A Comparison of four Methods for estimating the relative Toxicity of Stomach Poison Insecticides.**—*J. Econ. Ent.*, xxiii, no. 2, pp. 357–370, 4 figs., 5 refs. Geneva, N.Y., April 1930.

Methods tested with a view to discovering the best means of carrying out a general survey of toxicity [*R.A.E.*, A, xviii, 481] include a study of the relative effect of acid lead arsenate and sodium fluosilicate on the larvae of *Culex pipiens*, L., by the method of Marcovitch [*R.A.E.*, B, xvi, 178]. In each of 8 beakers 10 mature larvae of *C. pipiens* were placed in 50 cc. water. Four quantities of acid lead arsenate and of sodium fluosilicate, 25, 50, 75 and 100 mgm., were added rapidly to the beakers and stirred. Each of the 4 quantities of the fluosilicate was completely soluble in 50 cc. of water. The experiments were repeated six times. The speed of the toxic action of the arsenate was constant over the range of quantities used, whereas that of the fluosilicate was directly proportional to the concentration. This difference is attributed to the insolubility of the arsenate as compared with the complete solubility of the fluosilicate, which appears to be from 0·6 to 1·8 times as toxic as the arsenate according to the quantities compared. Since this method may yield widely different results, depending on the quantities compared, the species of larva and its environment, and since the results do not necessarily apply to insects against which stomach poisons are ordinarily used, the author considers that the simple cage test with appropriate insects is a better method for estimating the relative effectiveness of stomach poisons.

PEREZ (M.). **An Anopheline Survey of the State of Mississippi.**—*Amer. J. Hyg.*, xi, no. 3, pp. 696–710, 3 figs., 4 maps. Baltimore, Md., May 1930.

The species of *Anopheles* recorded from Mississippi are *A. quadrimaculatus*, Say, *A. punctipennis*, Say, *A. crucians*, Wied., *A. atropos*, D. & K., and *A. barberi*, Coq. *A. atropos*, which breeds in salt marshes, and *A. barberi*, which breeds in tree holes, have a limited range, but the other three species have frequently been observed at widely separated points. As *A. quadrimaculatus* is an important vector of malaria in the south-eastern United States, an Anopheline survey of Mississippi was undertaken from June to September 1929. *A. quadrimaculatus* and *A. punctipennis* are distributed throughout the State, but show some variation in relative regional abundance. The former was commonly found in lakes, ponds and slow-moving streams, and the intensity of malaria is proportionate to its relative abundance. The latter was not so often collected in old excavations with high ground water, but showed a great preference for flowing intermittent streams ; it does not exhibit a similar relation to malaria. *A. crucians* is most abundant in the southern part of the State and was found in the same types of breeding-place as *A. quadrimaculatus*, though it showed a decided preference for permanent water, whereas the other species breed freely in water of a temporary nature. In no instance were any of the species found in the presence of blue-green algae.

HILL (R. B.). **Classification of certain *Anopheles* of the *Nyssorhynchus* Group by immediate Examination of the Male Genitalia.**—*Amer. J. Hyg.*, xi, no. 3, pp. 711–713, 1 pl., 5 refs. Baltimore, Md., May 1930.

In northern Venezuela four Anophelines of the *Nyssorhynchus* group, *Anopheles albimanus*, Wied., *A. tarsimaculatus*, Goeldi, *A. strodei*, Root, and *A. bachmanni*, Petrocchi, are the ones most likely to be confused, and in these species the most characteristic structure of the genital segments is that formed by the fused dorsal segments. The author describes a method of examining the males in their fresh state immediately after chloroforming them, by means of which this structure is readily seen and identification is quickly and accurately made. The specimen is not mutilated and can be preserved for future study. The characters of these dorsal lobes in the four species are described and figured. In the other species of the *Nyssorhynchus* group found in Venezuela, namely, *A. albitarsis*, Lynch, *A. darlingi*, Root, and *A. argyritarsis*, R.-D., these lobes are inconspicuous structures, which on this account are not usually employed for differentiation.

PINTO (C.). **Mosquitos da região neotropica (Brasil, S. Paulo). I. (Diptera : Culicidae).**—*Mem. Inst. Oswaldo Cruz*, xxiii, no. 3, pp. 153–157, 3 pls. Rio de Janeiro, March 1930.

This annotated list of mosquitos observed in the State of S. Paulo, Brazil, from 1926 to 1929 includes the following Anophelines : *Anopheles evansi*, Brèthes, which is fairly common and of which *A. strodei*, Root, is considered a synonym ; *A. argyritarsis*, R.-D., very common in rural dwellings by night, but rare by day ; *A. albitarsis*, Arrib., which is

numerous and enters dwellings by night, being also found in rural dwellings by day ; *A. rondoni*, Neiva & Pinto, which is common at the end of March and enters rural dwellings by night ; *A. tarsimaculatus*, Goeldi, and *A. lutzi*, Cruz, rare in some places and fairly common in others ; and *A. darlingi*, Root, *A. fluminensis*, Root, *A. maculipes*, Theo., and *A.* (*Chagasia*) *fajardoi*, Lutz, all of which are rare. The yellow fever mosquito, *Aëdes argenteus*, Poir. (*Stegomyia aegypti*, auct.) is common. In one locality adults of both sexes were taken in a dense wood about 330 yards from dwellings.

GREEN (R.). **Observations on some Factors influencing the Infectivity of Malarial Gamete Carriers in Malaya to** *Anopheles maculatus*.— *Bull. Inst. Med. Res. F.M.S.*, no. 5 (1929), ii+41 pp., 12 tables, 2 charts, 40 refs. Kuala Lumpur, 1929. (Recd. 1930.)

This paper contains the results of an extensive series of experiments to determine the influence of various factors on the susceptibility of *Anopheles maculatus*, Theo., to infection with *Plasmodium falciparum*, *P. vivax* and *P. malariae*, in Malaya. The object of the investigations was to obtain data bearing on the possibility of adopting a system of treating carriers of gametes as an accessory anti-malaria measure.

Batches of ten mosquitos were allowed to feed on patients with gametes in their blood ; seven days later, dissections of the midgut of half the surviving mosquitos that had taken blood were made to determine the presence of oocysts, and after 16–18 days the midgut and salivary glands of the remainder were examined for oocysts and sporozoites. If only batches of *A. maculatus* in which infection occurred are considered, the percentage of mosquitos that became infected was 43·4 with *P. falciparum*, 39·3 with *P. vivax*, and 21·4 with *P. malariae*. The minimum number of gametes in the blood necessary to infect *A. maculatus* was 1 to 200 leucocytes or 42 to 1 cu. mm. of blood with *P. falciparum*, 1 to 1,000 leucocytes or 10 to 1 cu. mm. of blood with *P. vivax*, and 1 to 330 leucocytes or 27 to 1 cu. mm. of blood with *P. malariae*. On the basis of these figures, examination of a thick blood film for five minutes should be sufficient to determine whether a patient may be regarded as potentially infective to *A. maculatus*.

With *P. falciparum* and *P. vivax*, sporozoites were found in the salivary glands, and it was concluded that *A. maculatus* can transmit both malignant tertian and benign tertian malaria. With *P. malariae*, however, only immature oocysts were found, and there was no evidence of the formation of sporozoites, so that further experiments are needed to prove that this mosquito can transmit quartan malaria.

No adequate explanation of the failure to infect mosquitos in some cases in which there were large numbers of gametes in the blood is afforded by a consideration of the variations occurring in the proportion of male to female gametes, the proportion of young or abnormal gametes, the degree of fever, the presence of trophozoites or the leucocyte counts when the mosquitos fed, the haemoglobin content of the ingested blood, the size of the spleen, or the blood group of the gamete carrier. None of these factors appears to provide a practical basis on which cases may be regarded as potentially infective or non-infective to mosquitos.

With regard to the effect of quinine on the infectivity of a patient for *A. maculatus*, mosquitos became infected as the result of feeding on a gamete carrier after a maximum of 16 days under treatment, in the case

of *P. falciparum* ; the reduction of the gametes of this parasite produced by the standard quinine treatment generally adopted in Malaya (10 grains thrice daily) is slow and somewhat irregular, and their viability is not affected by a dose 2 hours or more before the feeding of the mosquitos. The viability of the gametes is not affected by the usual doses of quinine 24 hours or more before feeding in the case of *P. vivax*, or 2 hours or more before in the case of *P. malariae*, but with both of these parasites the reduction of the number of gametes by quinine treatment is probably sufficiently rapid to render the patient uninfective to mosquitos within a fairly short period ; further investigation is needed to determine the minimum period. Quinine is much less effective, however, in breaking the aetiological chain between man and mosquito, particularly in the case of *P. falciparum*, than appears to be generally recognised, and the necessity for continuing the present measures for protecting patients in hospitals from the bites of mosquitos, and for controlling the larvae in the vicinity, is confirmed. The control of gamete carriers as a general anti-malaria measure does not appear to be justified at present in Malaya, although further research may show that it is practicable in restricted areas.

A brief description of the methods employed in feeding the mosquitos and keeping them alive in the laboratory [*R.A.E.*, B, xviii, 57], and notes on the technique of dissection and some observations made in the course of this work are given in appendices. A yeast-like organism and a fungus were found in the midgut of a number of mosquitos, both in those that contained *Plasmodium* and those that did not. When the infection of the midgut with these organisms was light, oocysts developed in normal numbers, but in a few cases the yeast or fungus filled the midgut or the fungus extended into the body cavity, and in these the mosquito either died or failed to show malarial infection.

STRICKLAND (C.) & CHOUDHURY (K. L.). **On trapping Adult Mosquitoes.**—*Ind. J. Med. Res.*, xvii, no. 4, pp. 1009–1014, 2 figs., 1 ref. Calcutta, April 1930.

An account is given of comparative tests carried out in Assam in 1927 and 1928 with the tea-box and basket traps for catching mosquitos [*R.A.E.*, B, xviii, 57]. The tea-box trap appears to be superior to the basket type by about 12 per cent. for catching both Culicines and Anophelines, and by 52 per cent. for females of the latter. A preference for it was shown by almost all the Anophelines caught.

MAYNE (B.). **A Study of the Influence of relative Humidity on the Life and Infectibility of the Mosquito.**—*Ind. J. Med. Res.*, xvii, no. 4, pp. 1119–1137, 1 pl., 17 refs. Calcutta, April 1930.

The effect of relative humidity on the dissemination of malaria is discussed from the literature. It has been shown that whereas humidity exercises no direct effect on the malaria *Plasmodium* in the mosquito, and although infected and uninfected mosquitos react in the same manner to atmospheric states, the temperature and humidity conditions compatible with the transmission of malaria are confined to a more restricted range than those favourable to the bionomics of the insect vector.

The following is taken from the author's summary of the results of experiments carried out to determine the minimum effective range of humidities permitting both life in the mosquito and viability of the imbibed malaria. In the case of *Culex fatigans*, Wied., and the organisms of bird malaria, the minimum effective range was observed to be 44–46 per cent. in two batches of mosquitos maintained at temperatures up to 72° F. and at temperatures above 80° F. At relative humidities under 42 per cent. and dry bulb temperatures of 73° F. or under, out of a total of 195 mosquitos tested, only 4 were induced to bite and these became infected. At temperatures above 80° F. at similar relative humidities, none of 128 survived more than 4 days nor became infected. At these temperatures and 43 per cent. humidity, 2 mosquitos survived 3 days, showing incipient parasite development.

In similar tests with Anophelines at temperatures under 67° F. and relative humidities from 38 to 55 per cent., *Anopheles culicifacies*, Giles, and *A. subpictus*,Grassi, failed to survive one week, whereas more than 200 specimens of *A. fuliginosus*, Giles, survived fully 17 days at a minimum relative humidity of 38 per cent. At temperatures above 80° F., these 3 species failed to resist a desiccating atmosphere of 40–42 per cent. for more than 24 hours. At relative humidities of from 55 per cent. upwards and temperatures above 80° F., and at relative humidities above 57 per cent. and temperatures below 67° F., all 3 species survived from 1 to 4 weeks.

The experiments on the effect of relative humidity on the development of malaria parasites (*Plasmodium vivax*) in *A. subpictus* and *A. stephensi*, List., resulted in the survival and infection of 2 of the former during 1–3 days at 39–42 per cent. humidity and 4 during 6–13 days at 54–59 per cent., the temperature being 84–86 and 88–90° F. In the second test, development in the mosquitos was carried to the sporozoite stage. Three out of six individuals of *A. stephensi* that succeeded in biting a patient demonstrated various stages of plasmodial infection during a course of 5–11 days at 80–88 per cent. humidity and 85·5° F. Only one showed a few gland sporozoites.

In these tests, a definite result was obtained indicating a species adaptation to relative humidity. This consisted of an effective range of humidity allowing for an infective period in the mosquito at an optimum temperature for functioning. The following range of minimum relative humidity was established: *A. fuliginosus*, 38–40, *C. fatigans*, 43–45, *A. subpictus* and *A. stephensi*, 55–58, and *A. culicifacies*, 57–62. It was determined that, during an aestivating period involving a relative humidity of 44–50 per cent., infected mosquitos (*C. fatigans*) survived for periods up to more than 3 weeks (24 days). These had been maintained at normal high humidities for 10 days previously. Of these, 78 per cent. retained their parasites during the period of enforced drought, contrasted with 72 per cent. of control individuals, which remained infected through the 34 days of the experiment.

The relation of relative humidity to the stimulus of seeking blood in *C. fatigans* was tested. The results indicate that biting does not occur at relative humidities under 52 per cent. even in the presence of high dry bulb temperatures. This demonstrates that this mosquito cannot be induced to bite in an atmosphere of relative humidity in which it is unable to survive desiccation.

Iyengar (M. O. T.). **Dissolved Oxygen in Relation to *Anopheles* Breeding.**—*Ind. J. Med. Res.*, xvii, no. 4, pp. 1171–1188, 1 fig., 17 charts, 1 ref. Calcutta, April 1930.

An account is given of investigations in the Sonarpur area in Bengal on the variation in the amount of dissolved oxygen in collections of stagnant water and the relation of oxygen concentration to the breeding of Anophelines. The dissolved oxygen content of the ditches and ponds ranged from 0 to 6·5 mgm. per litre, but the greater proportion of the breeding-places had a content of 1–4 mgm. The Anophelines breeding in these stagnant pools, which included *Anopheles barbirostris*, Wulp, *A. fuliginosus*, Giles, *A. minimus* var. *varuna*, Iyengar, *A. subpictus*, Grassi, *A. hyrcanus* var. *nigerrimus*, Giles, and *A. pseudojamesi*, Strick. & Chdy., did not show any definite relation to the concentration of dissolved oxygen, except in the case of the last two species, which showed diminished prevalence with increasing oxygen concentration. It is, however, possible that even this apparent relation is due to the association of these two species with the aquatic plant, *Pistia*. All the species studied were found to breed in all grades of dissolved oxygen concentration, and there was no evidence of any oxygen toleration limit in any of them.

Anopheline larvae breeding in a pond were found to be in no way affected by the great fluctuation in the oxygen content that occurs during the course of each day. These remarkable diurnal variations in the water of ponds are discussed in detail. The lowest level for the day is reached at 6 a.m. and the highest at 2.30–3.30 p.m. These fluctuations are normal phenomena observed in every pond investigated. They are caused by the process of oxygen production through photosynthesis during the daytime and the using up of oxygen through respiration by the plant and animal life of the pond throughout the day and night. The highest oxygen concentration of pond water is reached when the sunshine is strongest and when the temperature of the water is therefore highest. Minute algae play a very large part in the increase of the dissolved oxygen concentration of the water.

The technique employed in water collection and the estimation of dissolved oxygen is described in an appendix, and tables show the frequency of the occurrence of Anophelines and the average number of larvae of each species found in any one breeding-place in ponds with different concentrations of dissolved oxygen, and give records of the variation of oxygen content in certain ponds.

Basu (B. C.). **The *Anopheles stephensi* Problem in Calcutta.**—*Ind. Med. Gaz.*, lxv, no. 4, pp. 185–191, 4 figs., 3 fldg. tables, 21 refs. Calcutta, April 1930.

This study of the seasonal prevalence and breeding-places of *Anopheles stephensi*, List., in a thickly populated area of about 1 square mile in central Calcutta was made from July 1928 to June 1929. *A. stephensi* is responsible for such danger with regard to malaria as exists in this part of the city [*cf. R.A.E.*, B, ix, 124, 125]. The larvae are found in all kinds of receptacles, but the most important breeding-places are masonry and galvanised iron tanks for the storage of filtered and unfiltered water in houses, with capacities ranging from 50 to 500 gallons or more. These tanks are also breeding-places of *Aëdes argenteus*,

Poir. (*aegypti*, auct.) and therefore constitute a danger in regard to dengue.

Larvae of *A. stephensi* were most numerous in July, August and September, and scarcest from November to February and in May, their abundance being closely correlated with rainfall, and less closely with temperature and humidity.

GRATCH (I.). **La malaria nel Comune di Ravenna. Cenni storici ed epidemiologici.** [Malaria in the Commune of Ravenna. Historical and epidemiological Notes.]—*Riv. Malariol.*, ix, no. 1, pp. 1–34, 7 maps, 34 refs. Rome, 1930. (With Summaries in Italian, p. 92, French, p. 93, English, p. 94, German, p. 95.)

At the present time malaria is endemic in Ravenna, but is not very serious. Measures against Anophelines are now regularly carried out and include oiling and dusting with Paris green. In experiments, a proprietary larvicide, "Leron", which is a mixture of various mineral oils and is claimed to be harmless to fish and cattle, proved satisfactory at the rate of 10 cc. per sq. metre of water surface, even in ponds with dense vegetation (which is not the case with petroleum), it being sufficient to move the reeds, etc., a little in order to ensure a uniform spread.

CORRADETTI (A.). **Sulle modificazioni delle larve di *Anopheles* in relazione col colore dell'ambiente.** [On the Changes in the Larvae of *Anopheles* in Relation to the Colour of the Surroundings.]—*Riv. Malariol.*, ix, no. 1, pp. 35–39, 5 refs. Rome, 1930. (With Summaries in Italian, p. 92, French, p. 93, English, p. 95, German, p. 96.)

The author has carried out experiments on the same lines as those of Achundow [*R.A.E.*, B, xvii, 32]. First-stage larvae of *Anopheles maculipennis*, Mg., from the same parent produced light-coloured larvae, pupae and adults when bred in light-coloured containers, and dark individuals in dark containers. There was, however, no difference in the size of larvae, pupae or adults. The average numbers of maxillary teeth were 13·5, 13·82, 14·1, 14·25 and 14·7 in adults from the green, black, maroon, grey and white containers respectively. These figures are based on the examination of only thirty mosquitos for each colour. Development from egg to adult was accelerated in the white container, was less rapid in the maroon, black and grey ones, and was retarded by 3–4 days in the green one. The darker colour is not due to accumulation of pigment, but, probably, to physico-chemical changes in the protoplasm. It was also shown that the green colour that often appears in fourth-instar larvae is not due, as has generally been supposed, to feeding on algae, as it occurred in larvae that had only received other food.

PETTIT (A.), ROUBAUD (E.) & STÉFANOPOULO (G.). **Fièvre jaune du singe consécutive aux piqûres par stégomies de Tunisie, de Java et de Cuba.**—*C. R. Soc. Biol.*, civ, no. 15, pp. 60–63, 3 refs. Paris, May 1930.

In order to determine whether yellow fever could be transmitted by mosquitos from countries where the disease does not exist [*cf. R.A.E.*,

B, xvii, 111, etc.], experiments were undertaken in Paris with strains of *Aëdes argenteus*, Poir. (*aegypti*, auct.) originating in Tunis, Java and Cuba. In the case of mosquitos from Tunis fed on infected monkeys (*Macacus rhesus*) only two subsequently attacked a healthy monkey and only one absorbed blood, but the monkey died of typical yellow fever. Mosquitos from Java that bit two monkeys inoculated with yellow fever failed to transmit the disease, probably because they only engorged on one of the inoculated monkeys, which was subsequently shown to be uninfected. Two monkeys, bitten by a second batch of mosquitos from Java fed on infected monkeys, showed no signs of infection, but whereas one died after inoculation with the disease, the other proved resistant to two inoculations. Negative results were obtained with the Cuban strain. Mosquitos of a strain from Senegal fed on infected monkeys were subsequently allowed to bite a healthy animal; this monkey exhibited no signs of the disease but proved resistant when inoculated, showing that it had contracted a mild infection sufficient to confer immunity.

The first experiment was carried out in May, whereas when the other experiments were undertaken the temperature was only slightly above freezing point, and it is suggested that in spite of the precautions taken, the cold may have exerted some effect on the transmitting power of the mosquitos. It is pointed out that the mosquitos originating in Senegal, where yellow fever is endemic, were not more effective than those from Tunis or the Dutch East Indies.

PHILIP (C. B.). **The experimental Transmission of Yellow Fever by Mosquitoes.**—*Science*, lxxi, no. 1850, pp. 614–615, 7 refs. New York, N.Y., 13th June 1930.

In further tests of the transmission of yellow fever [*cf. R.A.E.*, B, xviii, 147], carried out in Nigeria with other species of mosquitos, no reaction was produced by bites, but injections of saline suspensions of *Aëdes irritans*, Theo., *A. nigricephalus*, Theo., *A. punctocostalis*, Theo., and *Culex thalassius*, Theo., caused fatal infections after the adequate incubation periods following the initial infecting meal. The transmission of the disease by *A. luteocephalus*, Newst. [xvi, 236], was confirmed. Experiments indicated that in certain species complete distribution of the virus through the body does not occur. *A. irritans* retained the virus for as long as 51 days as proved by subsequent injection. The author is convinced from biological studies that *Taeniorhynchus africanus*, Theo., is the most dangerous of the potential vectors in West Africa. It readily bites man, feeds more than once, and is present in houses in varying numbers at all seasons.

The work that has been recorded by various authors on the experimental vectors of yellow fever is reviewed, and reference is made to mosquitos that are likely to be found to transmit the disease in future experiments.

SYMES (C. B.). **Anophelines in Kenya.**—*Kenya & E. Afr. Med. J.*, vii, no. 1, pp. 2–11, 5 pls. Nairobi, April 1930.

Since the early months of 1926, when an epidemic of malaria occurred almost throughout Kenya Colony, investigations on the distribution

and habits of the adults and larvae of Anophelines have been undertaken. The following species are recorded : *Anopheles gambiae*, Giles (*costalis*, Tneo.), *A. christyi*, Newst. & Cart., *A. cinereus*, Theo., *A. funestus*, Giles, *A. transvaalensis*, Cart., *A. mauritianus*, Grp., *A. pretoriensis*, Theo., *A. maculipalpis*, Giles, *A. implexus*, Theo., *A. squamosus*, Theo., *A. pharoensis*, Theo., *A. rufipes*, Gough, *A. rhodesiensis*, Theo., *A. marshalli*, Theo., *A. longipalpis*, Theo., *A. ardensis*, Theo., *A. nili*, Theo., *A. natalensis*, Hill & Haydon, and *A. symesi*, Edw. *A. christyi* and *A. cinereus* are the most widespread, whereas *A. nili*, *A. natalensis*, *A. implexus* and *A. pharoensis* appear to be restricted to certain relatively small areas. Over 15,000 searches were made in European, Indian and African dwellings, cattle sheds and stables, and of the ten species discovered only *A. gambiae*, *A. funestus*, *A. christyi* and *A. cinereus* occurred in numbers. *A. christyi* and particularly *A. cinereus* appear to be definitely attracted to cattle ; they occur in dwellings occasionally, but in very small numbers. In all areas dealt with, *A. gambiae* and *A. funestus* are pre-eminently the domestic species. The former, the larvae of which usually occur in open, stagnant water, is most numerous soon after the rains begin and breeds throughout the wet season. *A. funestus* prefers shaded, clear water, and the largest numbers occur when the rivers regain their normal flow after the rainy season, although where grass and reed swamps exist it may also be abundant during the rains. *A. funestus*, though fairly widely distributed, is usually much less numerous than *A. gambiae* except in certain areas that are peculiarly suited to its breeding. A very high incidence of this species is usually suggestive of a large surface area of breeding grounds, since conditions conducive to its production appear to inhibit any very great density of larval population, such as may be found in the breeding grounds of *A. gambiae* or *A. christyi*.

Precipitin tests of the stomach contents of *A. gambiae* showed that 82·3 per cent. of the 1,011 individuals tested contained human blood. With regard to the use of cattle as a barrier against domestic Anophelines, it is pointed out that although *A. gambiae* is attracted to man, it appears to feed readily and thrive on domestic and wild animals. On the other hand in a locality previously unpopulated for at least ten years, this mosquito exhibited the greatest readiness to feed on man. Thus, even if a township could be freed of mosquitos and surrounded by a barrier half a mile in width in which numerous cattle were distributed, so that Anophelines outside the barrier would not penetrate into the town, there is no proof that they would refuse to feed on man should the opportunity occur. Additional data on this subject were obtained in a locality where the native women and children live in huts together with cattle, which are tethered to a line of poles down the middle of the hut. There was no lack of Anophelines (*A. gambiae* and *A. funestus*) in the huts, and, in spite of the fire and the more accessible cattle, most of the mosquitos were found in the vicinity of the sleeping place. Moreover, among the children the parasite rate was 50–60 per cent. and the spleen rate 85–100 per cent., so that little protection appears to be provided by the presence of the cattle. These and other observations showed that domestic Anophelines are numerous in huts in spite of their smoky atmosphere [*cf. R.A.E.*, B, xv, 227 ; xvii, 249].

Both *A. gambiae* and *A. funestus* are naturally infected and infective in Kenya. Stomach infections are not considered a reliable indication of active infection, so that routine examinations were confined to the

glands. In April 1929, 7·2 per cent. of the 90 specimens of *A. gambiae* examined gave positive results, and in one district one out of 15 individuals of *A. funestus* was infected. Other species have only been examined in small numbers, and so far negative results have been obtained.

From data collected in Nairobi it was found that the seasonal rise in malaria incidence corresponded to the increase in the numbers of *A. gambiae*, which in turn followed the rise in the precipitation rate. The importance of *A. gambiae* as a domestic species is emphasised by the fact that it was not the predominant mosquito. In four separate districts where, so far as can be ascertained by spleen measurements and blood examination, no malaria occurs, eight species of Anophelines were found but *A. gambiae* was not recorded.

A fairly reliable record of the flight of this mosquito over a distance of three miles was obtained, but in general the limit of dispersal from any breeding ground is not greater than a mile and is usually less.

Studies on hydrogen-ion concentration undertaken in 1926 showed that, given the particular type of breeding ground in which it is normally found, none of the six species studied is influenced by changes of pH within the limits usually found in natural waters, *viz.*, 5·9–8·4.

Papers noticed by Title only.

Iyengar (M. O. T.). **The Larva of** *Anopheles turkhudi* [detailed description].—*Ind. J. Med. Res.*, xvii, no. 4, pp. 1189–1193, 1 pl., 1 fig., 4 refs. Calcutta, April 1930.

de Buen (E.). **Etude expérimentale sur quelques méthodes employées dans la lutte contre les larves d'Anophèles** [Paris green, *Gambusia*, etc., in Spain].—*Bull. Soc. Path. exot.*, xxiii, no. 4, pp. 402–427, 1 fig. Paris, 1930. [*Cf. R.A.E.*, B, xviii, 154.]

Kröber (O.). **Die Tabanidengattung** *Sackenimyia* **Big.**—*Zool. Anz.*, xc, no. 1–2, pp. 1–12, 6 figs. Leipzig, 10th July 1930.

Zernoff (V.). **L'immunité passive et la sérothérapie chez les insectes (chenilles de** *Galleria mellonella*).—*Ann. Inst. Pasteur*, xliv, no. 5, pp. 604–618, 15 refs. Paris, May 1930.

Bagnall (R. S.). **On Ecto-Parasites, Lice and Host Ancestry.**—*Vasculum*, xvi, no. 2, pp. 46–50. Newcastle-upon-Tyne, May 1930.

Bagnall (R. S.). **The Anoplura (Sucking Lice) of Northumberland and Durham.**—*Vasculum*, xvi, no. 3, pp. 103–106. Newcastle-upon-Tyne, August 1930.

Rondelli (M. T.). **Ixodoidea del Museo di Milano.**—*Atti Soc. ital. Sci. nat.*, lxix, pp. 112–124, 2 figs. Milan, 1930.

Austen (E. E.). **A new Hippoboscid Parasite** [*Ornithomyia comosa*, sp. n.] **(Diptera Pupipara) of the Indian Sand-Martin** [*Riparia paludicola chinensis*].—*Ann. Mag. Nat. Hist.*, (10) v, no. 29, pp. 560–561. London, May 1930.

Hirst (S.). **On a new Species of Tick** (*Ixodes victoriensis*, **sp. n.) from Victoria, Australia.**—*Ann. Mag. Nat. Hist.*, (10) v, no. 29, pp. 575–576. London, May 1930.

Bequaert (M.) & Walravens (P.). **Phlébotomes du Katanga.**—*Rev. Zool. Bot. afr.*, xix, fasc. 1, pp. 34–42, 9 figs., 4 refs. Tervueren, Brussels, 15th April 1930.

The sandflies recorded from the province of Katanga, Belgian Congo, are *Phlebotomus africanus* var. *congolensis*, n., and *P. katangensis*, sp. n., which are described, and *P. ingrami*, Newst. The last two species are apparently very rare.

[McHardy (J. W.).] **Report of Government Entomologist.**—*Ann. Rep. Med. Lab. Dar es Salaam 1928*, pp. 41–52, 1 pl., 1 ref. London, 1930.

A device for determining the maximum size of the mesh of wire netting through which house-flies [*Musca*] cannot pass without first settling on it is described. The netting was brushed over with hot fly gum, prepared by dissolving resin in crude castor oil. The flies were observed to fly through the netting with a mesh 1 inch wide on a few occasions only, but not through that with a mesh of $\frac{3}{4}$ in.

In a further experiment a piece of wire netting of $\frac{3}{4}$ in. mesh, 36 ins. by 18 ins., was soldered to a frame 36 ins. wide and 20 ins. high, made by bending a piece of stout wire 76 ins. long, a projecting leg 2 ins. long being thus left at each end of the frame, so that it could be fixed to a convenient stand. Three of these frames were arranged transversely 4 or 5 ft. apart on a table 36 ins. wide, and after two days about 2,000 flies had been caught on each. It is suggested that such frames, if placed along market tables from which meat, etc., is sold, would trap numbers of flies.

A report on the survey of the Anophelines on the Tanga-Arusha railway [*R.A.E.*, B, xviii, 162] and notes on the breeding-places of a number of species of mosquitos in Tanganyika are included.

The investigation on rat-fleas [xvii, 72] has been continued; the average numbers per rat throughout the study of *Xenopsylla brasiliensis*, Baker, and *X. cheopis*, Roths., were 1·1 and 0·56 respectively.

Connal (A.). **Annual Report of the Medical Research Institute, 1928.**—*Ann. Med. & Sanit. Rep. Nigeria 1928*, Appx. A, pp. 1–45, 5 pls., 1 chart. Lagos, 1929. [Recd. 1930.]

In connection with the investigations on rat plague in Lagos, more detailed data on the seasonal prevalence of *Xenopsylla cheopis*, Roths., and *X. brasiliensis*, Baker, are given than in previous years [*R.A.E.*, B, xv, 39; xvi, 262], weekly as well as monthly indices being given for the fleas from live rats. The average number of fleas per rat was highest in August and September, and there was a considerable increase in the number of infected rats from the end of September to the beginning of November. In each month, the total number of *X. cheopis* from all rats was greater than that of *X. brasiliensis*, the proportion sometimes being as high as three to one.

The breeding-places and seasonal prevalence of the larvae of 15 species of mosquitos are recorded, and lists of mosquitos and other blood-sucking Diptera from several localities are given.

(13460) Wt P5/3534 1,700 10/30 H & Sp Gp 52

Johnson (W. B.) & Lloyd (Ll.). **Report of Tsetse Investigation, 1928.**—*Ann. Med. & Sanit. Rep. Nigeria 1928*, Appx. B, pp. 47–64, 2 pls., 4 maps, 3 refs. Lagos, 1929. [Recd. 1930.]

The experimental clearing for the elimination of the main foci of *Glossina morsitans*, Westw., and *G. tachinoides*, Westw., at Sherifuri [*R.A.E.*, B, xv, 167 ; xvi, 262] was continued in 1928. The policy of confining the clearing to the neighbourhood of pools and streams, and not cutting into the general savannah, was maintained. A further area of 3,402 acres was cleared during the year, bringing the total to 5,914 acres. The result of this clearing is that within an area of about 100 square miles no forest suitable for infestation by tsetse in the later part of the dry season remains, except that fringing the pool that was fenced round to exclude game. It has been found that the wet season spread will carry both *G. morsitans* and *G. tachinoides* at least three miles into clearings from which they retire or die out as the dry season advances. Farming greatly reduces the wet season invasion, but only comparatively small areas in the clearings have been successfully farmed.

An attempt was made to clear established thicket surrounding a pool, by stacking grass round the outer edge and then setting fire to it. Although the fire was fierce, it failed to penetrate the thicket to any considerable depth, and did not kill the roots. Experiments with marked individuals of *G. tachinoides* indicated that the fire had killed about half of those in the thicket, as only 8·4 per cent. of those released the day before the fire were caught the day after, whereas under normal conditions about 16 per cent. would have been recovered. The focus was entirely repopulated in the following wet season, the number of flies caught per net-hour in October being 53 as compared with a maximum of 48 in the previous year. It is therefore evident that the method is of no value in Nigeria.

In preliminary experiments with suspensions, *in vitro*, of the developmental forms of *Trypanosoma congolense* from the midgut of *G. morsitans*, it was found that the optimum salt condition was 0·85–0·9 per cent. sodium chloride, and the optimum hydrogen-ion concentration pH 5·9–6·4. The best condition was given in saline solution acidified with sodium phosphate (NaH_2PO_4) to pH 6·2, this being approximately the pH of the midgut of the fly. Bacterial infection was found to destroy the developmental forms of *T. congolense* rapidly, either *in vivo* or *in vitro*. Fresh sera of duiker antelope, wild hare, *Varanus*, donkey, fowl, rabbit, man, and, to a less extent, sheep were actively trypanolytic, *in vitro*, to developmental forms of *T. congolense*. Fresh sera were also actively trypanolytic to developmental forms of *T. vivax*. The knowledge that the blood of many animals that form the natural food supply of the fly is actively trypanolytic and agglutinative to the developmental forms of trypanosomes suggested that this factor might be of importance in determining the rate of infection in wild flies, and might account for the low rate in *G. tachinoides* as compared with *G. morsitans* in the same locality, since the former takes blood from reptiles as well as ungulates, whereas the latter never takes reptile blood. This theory was supported by experiments in which individuals of *G. tachinoides* were fed first on goats infected with *T. congolense* and *T. vivax* or on a dog infected with *T. brucei*, and then on a healthy sheep or goat or on *Varanus*. *T. congolense* and *T. brucei* were unable to develop in flies fed on *Varanus*, although the infection rate with

T. congolense was 6·7 per cent. in flies fed on a sheep, and with *T. brucei*, 52·5 and 29 per cent. in flies fed on goats. With *T. vivax*, the infection rate was 30 per cent. in flies fed on a sheep and 10 per cent. in those fed on *Varanus*. Further experiments showed that, except in one case, the infection rate was higher in infected flies given a subsequent feed on healthy mammals than in those fed on inactivated mammalian blood.

It would appear that although feeding on an intensely trypanolytic blood may diminish the infection rate in tsetse-flies, the trypanosomes in the gut of the fly must have some protection against the action of the fresh blood ingested. This protection may be mechanical, or may be afforded by enzyme action of salivary juice or gut secretion. Salivary and gut extracts failed to show protective action. In the case of *T. vivax*, which develops in the proboscis of the fly, contact with fresh blood is made for a short period only, during the act of feeding. In cases where the preliminary development occurs in the gut of the fly, it is possible that the peritrophic membrane is the protecting factor; sections through the proventriculus and midgut of flies infected with *T. congolense* show the trypanosomes lying between the peritrophic membrane and the gut wall, and so not coming into contact with the ingested blood until this has been at least partly altered by digestion. The peritrophic membrane, which is a delicate tube secreted by the proventriculus and flowing back along the midgut, is presumably often broken, and capable of repair, and this may account for the uncertainty with which infections develop in the individuals of a group of flies fed on an animal infected with *T. brucei*, *T. gambiense* or *T. congolense*. An accident to the peritrophic membrane would allow the trypanosomes to come into contact with the unchanged blood, so that the trypanolysins would affect them.

No differences were demonstrable between the infection rate of newly emerged tsetse-flies and that of mature ones, but there is some evidence that starvation may cause degeneration of the developmental forms of trypanosomes within the flies.

In connection with tests for immunity from trypanosomiasis, it was thought necessary to find out the number of trypanosomes injected by a fly in the process of sucking blood. Direct counts were made of infective and transitional forms in the hypopharynx of freshly caught flies carrying mature infections, and of infected flies that were allowed to engorge on a goat immediately before being dissected. With *T. vivax*, the average number of trypanosomes in the hypopharynx of *G. morsitans* was 158 (maximum 1,000, minimum 1) in 50 freshly caught infective flies, and 93 (maximum 609, minimum 0) in 46 flies directly after feeding. With *T. vivax* in *G. tachinoides*, the average number in 14 freshly caught flies was 145 (maximum 467, minimum 4). With *T. congolense* in *G. morsitans*, the average was 268 (maximum 604, minimum 15) in 9 freshly caught flies, and 256 (maximum 1,000, minimum 0) in 9 that had just fed. In two cases the trypanosomes were so massed that they could not be counted, and their number was estimated at 1,000; such a massive infection is apparently relatively seldom dislodged from the hypopharynx during feeding, and it is evident that even with light infections, a comparatively small proportion of the trypanosomes is injected into the host with the salivary secretion. It would appear that 1,000 would be a somewhat excessive number of trypanosomes with which to test the resistance of a possibly immunised

animal to *T. vivax* and *T. congolense*, whereas 1 cc. of the blood of a heavily infected animal may contain many millions of trypanosomes. Whether the infective forms in the fly are more or less virulent than those in the blood stream, which would normally be used in testing immunity, remains to be discovered.

JACK (R. W.). **Tsetse Fly: Traffic Control.**—*Rhodesia Agric. J.*, xxvii, no. 5, pp. 493–501, 1 pl. Salisbury, May 1930.

In Southern Rhodesia, an important problem in tsetse-fly control is produced by the very marked tendency of *Glossina morsitans*, Westw., to accompany moving objects, such as motor vehicles, cyclists and even pedestrians, for considerable distances. In this way flies tend to be carried out of fly areas and may be responsible for sporadic outbreaks of trypanosomiasis among cattle in otherwise fly-free localities. In 1929, a law was passed providing for the control of traffic leaving infested areas [*R.A.E.*, B, xvii, 162]. This control was only necessary in two localities where fly areas were in actual contact with settlements or sufficiently close to make the risk from transported flies appreciable. It is considered impracticable to control pedestrian traffic; the danger is much less than with vehicles, for within limits it appears that the faster the movement, the more the flies are attracted and the further they tend to be carried, and the distance to which they are normally carried by pedestrians is probably not greater than that to which occasional flies may range without such assistance. Vehicular traffic, including cyclists, was restricted by regulation [xviii, 113] to certain defined and guarded routes. The difficulties encountered in enforcing the regulations and in ridding the traffic of flies are discussed. The amount of traffic does not justify the appointment of a European for the work, and the application of effective fumigants by natives without supervision is impracticable. Smoke houses, similar to those used in Uganda [xvii, 120], have not proved satisfactory, as in the majority of experiments it was found that living flies were carried forward after treatment. Moreover, there is an appreciable danger of fire. Experiments are now being carried out with proprietary fly sprays. In the Lomagundi area, two chambers, similar in construction to the smoke houses used in Uganda, have been erected at the exit gates of the infested area to protect the vehicles from the wind during the spraying treatment. Flies carried by passengers alighting from a vehicle are caught in insect nets, and native cyclists are cleared of flies by the guard in special mosquito gauze cages. In the Gatooma area, in order to deal with the larger amount of motor traffic and also to admit of experiment with various methods of treatment, a fumigating chamber with a mosquito gauze ante-chamber has been constructed. Passengers are cleared of fly in the ante-chamber and the vehicles sprayed in the dark fumigating chamber. The door into the light ante-chamber is left ajar, and flies disturbed by treatment tend to fly into the lighter room where they are caught and killed.

WARBURTON (C.). **Annual Report for 1929 of the Zoologist.**—*J. R. Agric. Soc. England*, xc, pp. 365–372. London, 1929. [Recd. 1930.]

In conducting a campaign against warble-flies [*Hypoderma*] in cattle a wash consisting of 1 lb. powdered derris root, ¼ lb. soft soap and 1 gal. water is recommended. In further experiments with a

proprietary ointment previously tested [*R.A.E.*, B, xvii, 151] all the larvae treated were killed. The most satisfactory method of application was rubbing the ointment into the holes by hand or with a piece of cloth.

NEWMAN (L. J.) & ANDREWARTHA (H. G.). **Blowfly Parasite. The Red-legged Chalcid.** *Stenoterys fulvoventralis* (**Dodd**).—*J. Dept. Agric. W. Aust.*, (2) vii, no. 1, pp. 89–95, 1 pl. Perth, March 1930.

The economic importance of sheep blow-flies in Western Australia and the various measures adopted for their control are briefly discussed. The most encouraging of all parasites investigated is the local Encyrtid, *Stenoterys fulvoventralis*, Dodd, the adult of which is described. Since its discovery it has been reared and distributed, and it has become established in several districts in the State.

Both the larvae and the pupae of all species of blow-flies, excepting those of *Ophyra nigra*, Wied., are attacked, fully grown larvae being preferred. From 15 to 25 larvae of the parasite occur in each host, and they pupate within the pupa of the latter. The life-cycle varies from a maximum of 72 days in winter to a minimum of 29 in summer. In spring and autumn, when the parasites are most active, they require 5–7 weeks to reach maturity. They are present in the field all the year round and occur in large numbers on exposed carcases from March till the end of November; during the remaining months, however, their numbers are considerably smaller. During hot weather they are less active, and owing to low humidity conditions during December and January many of them are unable to cut their way out of the pupae of their host, especially in the case of *Chrysomyia* (*Pycnosoma*) *rufifacies*, Macq.

The parasites are despatched for distribution among farmers while they are still within the pupae of their host, so that they will emerge a few days after arrival. The package containing the parasites should be opened and placed in a jar containing moist sand and covered with muslin; they are then liberated on an exposed carcase as they emerge. An easier method is to place the parasitised blow-fly pupae under the carcases in sheltered positions, care being taken that none of the pupae is exposed to the sun. This has the disadvantage that some of the pupae may be destroyed by predatory beetles, etc., before the parasites emerge.

SPENCER (R. R.) & PARKER (R. R.). **Studies on Rocky Mountain Spotted Fever.**—*Bull. Hyg. Lab.*, no. 154, 116 pp., 12 pls., 17 figs., 12 pp. refs. Washington, D.C., U.S. Publ. Hlth. Serv., 1930.

This bulletin contains a series of papers by the same authors on the subject of Rocky Mountain spotted fever, some of which have been previously noticed, namely, "Infectivity of fasting and recently fed Ticks" [*R.A.E.*, B, xi, 89]; "Viability of the Virus in Animal Tissues" [xii, 60]; "Experimental Studies on Tick Virus" [xiii, 52]; "Vaccination of Monkeys and Man" [xiv, 4]; "A Study of the Relationship between the Presence of Rickettsia-like Organisms in Tick Smears and the Infectiveness of the same Ticks" [xiv, 103].

In "Variations in the Behaviour of the Virus" (pp. 49–60), the authors describe the existence of three phases, two in the tick, *Dermacentor venustus*, Banks (*andersoni*, Stiles) and one in the mammalian

host [*R.A.E.*, B, xvii, 127]. In adult ticks that have been infected in an earlier stage, the virulent phase is usually accompanied by a marked increase in rickettsiae throughout the tissues, but in the same phase in those recently infected as adults and re-fed, rickettsiae are not numerous and may be absent despite a high concentration of live virus. The authors' conception of these phases is based entirely upon the functional behaviour of the virus and not upon morphological characteristics of the associated rickettsiae. In ticks infected with Rocky Mountain spotted fever, they have encountered no microscopic forms of any kind that can be said to be a constant accompaniment of the infection; the presence of virus in ticks from nature can be verified or ruled out only by feeding the ticks and subsequently injecting the pounded viscera into susceptible animals, which must later be given an immunity test if infection does not follow either tick feeding or the injection of the tick viscera.

A paper entitled "Infection by other Means than Tick Bites" (pp. 60–63) describes experiments made to determine by what means, other than tick bites, the virus may gain access to the body of the susceptible host. The results indicate that tick virus has a penetrating power that blood virus does not possess, and it is suggested that blood virus will not easily infect through the normal unabraded skin, but that tick virus can do so readily. It is thought that cases of infection among workers in the laboratory have occurred in this way. It seems unnecessary, in view of the experiments described, to assume the occurrence of any natural vector other than *Dermacentor venustus* to explain certain human cases.

"Results of Four Years' Human Vaccination" (pp. 72–103) records in detail many cases of vaccination in various regions, using phenolised tick virus as the prophylactic [*cf.* xvii, 129, etc.]. These results suggest that partial protection, sufficient to ensure relatively mild infections and recovery, is usually conferred by vaccination against the extremely virulent strains of Rocky Mountain spotted fever, such as those of the Bitter Root Valley, Montana, while full protection is commonly given against the milder type of infection, such as that occurring in southern Idaho.

Brug (S. L.) & de Rook (H.). **Filariasis in Ned.-Indië. II. De overbrenging van** *Filaria malayi*. [Filariasis in the Dutch East Indies. II. The Transmission of *F. malayi*.]—*Geneesk. Tijdschr. Ned.-Ind.*, lxx, no. 5, pp. 451–474, 1 fig., 3 pls., 8 refs. Weltevreden, 1930. (With a Summary in English.)

An account is given of investigations in Sumatra which showed that *Filaria malayi* [*R.A.E.*, B, xvi, 41; xvii, 84] can be transmitted by *Taeniorhynchus* (*Mansonioides*) *annulipes*, Wlk., and *T.* (*M.*) *annulatus*, Leic., proboscis infection occurring about a week after the infecting feed. Both mosquitos were very abundant in the village where the studies were made, and 47·5 per cent. of the inhabitants were infected with *F. malayi*. *F. bancrofti* and its chief vector, *Culex fatigans*, Wied., were completely absent. The experimental and natural infection indices of *T. annulipes* were 93 per cent. and 1·2 per cent. respectively, those for *T. annulatus* being 83 per cent. and 1·9 per cent. With the extreme abundance of these mosquitos, the small natural indices seem sufficient to explain the prevalence of infection in man. Proboscis

infection was seen in naturally as well as in artificially infected mosquitos. After a rainy day both *T. annulipes* and *T. annulatus* were abundant in houses in the evening, but not after dry weather. They are attracted by light. They begin biting about 8 p.m., the attacks reaching a maximum about two hours later. In the morning only a few stragglers remain indoors, and all disappear by 8–9 a.m. Only a few individuals occur by day under the houses. In a swampy jungle about two-thirds of a mile away both species could be captured in numbers during the day, but they did not bite. Both in this jungle and indoors males were extremely rare.

It is probable that *T.* (*M.*) *uniformis*, Theo., and *T.* (*M.*) *annuliferus*, Theo., may also act as vectors of *F. malayi*, but they were too rare during these investigations to permit of a thorough examination. In *T.* (*Coquillettidia*) *giblini*, Tayl., and some species of *Aëdes* and *Culex* complete development of *F. malayi* did not occur.

DE ROOK (H.) & SOESILO (R.). *Anopheles* (*Bironella*) *papuae*.—*Geneesk. Tijdschr. Ned.-Ind.*, lxx, no. 5, pp. 475–481, 4 figs., 3 refs. Weltevreden, 1930. (With a Summary in English.)

Adults of *Anopheles* (*Stethomyia*) *aitkeni* var. *papuae*, Swellgr. [*R.A.E.*, B, viii, 136] were obtained from larvae collected in New Guinea and bred singly. The larva, female, male, and male genitalia are described, and it is concluded that this mosquito is a distinct species referable to the subgenus *Bironella*.

TIMMERMAN (W. A.). **Transmissieproeven met** *Bartonella muris*. [Transmission Experiments with *B. muris*.]—*Geneesk. Tijdschr. Ned.-Ind.*, lxx, no. 5, pp. 503–509, 5 refs. Weltevreden, 1930.

In further experiments at Bandoeng, Java [*cf. R.A.E.*, B, xviii, 162], *Xenopsylla cheopis*, Roths., and *Polyplax* (*Haematopinus*) *spinulosa*, Burm., transmitted *Bartonella muris* from rat to rat by biting. *X. cheopis* remains infective for three days; *H. spinulosa* for less than one. There is no reason for assuming that development of *B. muris* occurs in these insects. Though mites appear capable of transmitting the infection, they do so less readily.

RONDELLI (M. T.). *Ornithodorus franchinii*, **n. sp., un nuovo Argasidae della Tripolitania.**—*Boll. Zool.*, i, no. 3, pp. 113–115, 2 figs., 3 refs. Naples, 1930.

The adult female of *Ornithodorus franchinii*, sp. n., is described from specimens collected in the oasis of Ghadames, Tripoli. This is the tick recorded as probably *O. lahorensis*, Neum. [*R.A.E.*, B, xvii, 144] by Franchini, who states that it has been taken on sheep and gazelles and that it causes fever in man.

CAREW (J.). **Sheep Maggot Flies.**—*Queensland Agric. J.*, xxxiii, pt. 5, pp. 316–319, 3 figs. Brisbane, 1st May 1930.

A brief account is given of the more common methods of controlling sheep blow-flies in Queensland. During the first week or so carcases give off a considerable amount of moisture that attracts flies; for this reason, carrion should be destroyed or utilised as a trap by sprinkling

it with arsenic. Healthy sheep are least subject to attack, and steps should be taken to destroy all external and internal parasites, which tend to lower their powers of resistance. Jetting with a solution consisting of 7 lb. arsenic with an equal quantity of sodium carbonate in 100 gals. water has been found to give 90 per cent. protection for three months [*R.A.E.*, A, xi, 75, 177]. The length of the wool is unimportant so long as the mixture is forced through it to the skin, as long wool holds more poison and affords a greater amount of protection. The pressure necessary varies from 160 lb. per square inch for sheep carrying eight months wool to 60 lb. for crutched or shorn sheep. An ordinary race is not as satisfactory for jetting as a raised one, as an upward tendency in applying the jet is a decided advantage and the surplus solution that falls from the wool may be recovered. A cheap, simple and economically worked, raised race is described. Although evidence indicates that jetting is preferable, both maggots and flies may be controlled and the sheep protected for several weeks by dipping. For sheep with four months' growth of wool, a mixture of 2 lb. arsenic and 2 lb. sodium carbonate in 100 gals. water should be used. When the wool is longer, the strength may be reduced (to 1½ lb. for a nine months' growth) but the sheep should remain longer in the dip. Sheep should not be dipped immediately after shearing; about two weeks should elapse to allow the skin to recover and the cuts to heal.

CHESNEAU (P.) & TRAN-VAN-MANH. **Rhinomyiase à** *Chrysomyia bezzianum.*—*Bull. Soc. méd.-chir. Indochine*, vii, no. 8–9, pp. 410–413. Hanoi, 1929. [Recd. 1930.]

A case of myiasis of the nasal passages and palate in a native of Indo-China is described. More than 65 full-grown larvae of *Chrysomyia bezziana*, Villen., were extracted or expelled from the nostrils and mouth.

MORIN (H. G. S.). **Considérations sur l'enquête malariologique en Cochinchine : son but, sa technique, les services qu'on peut en attendre.**—*Bull. Soc. méd.-chir. Indochine*, vii, no. 8–9, pp. 436–454, 7 graphs. Hanoi, 1929.

The author discusses the methods and aims of malaria surveys, with special reference to the work carried out in Cochin China by the Pasteur Institute of Saïgon, and quotes several classical instances of the control of malaria by measures against the Anopheline vectors. *Anopheles maculatus*, Theo., is very common in the red soil region of Cochin China, although it does not occur in the grey soil region [*R.A.E.*, B, xv, 64], but it is very rarely found in houses. In the course of five months, searches for adult Anophelines in the dwellings of coolies, made during the day, mostly in places where malaria is endemic, resulted in the capture of 176 individuals of *A. minimus*, Theo., and only 3 of *A. maculatus*; nearly all were females engorged with human blood. Subsequent dissections showed that five out of 63 individuals of *A. minimus* were infected with malaria, three having sporozoites in the salivary glands and two having only sporocysts in the stomach. The localities in which *A. minimus* occurs in Cochin China are all highly malarious. Collecting mosquitos at night, on a single occasion, resulted in the capture of two individuals of *A. maculatus* that were about to suck blood.

Manalang (C.). **Coccidiosis in Anopheles Mosquitoes.**—*Philipp. J. Sci.*, xlii, no. 2, pp. 279–280, 2 pls. Manila, June 1930.

A description is given of two forms of oöcysts of *Coccidium*, either two species or two stages of the same parasite, found in 1928 and 1929 in 1–2 per cent. of the adults of all the common species of *Anopheles* from certain malaria control areas in Luzon Island. Only one case of larval infection was observed, in *Anopheles tessellatus*, Theo., but the oöcysts were found everywhere in the body of the adults, being most numerous in the thorax and the first three abdominal segments. Parasitised insects kept at 23–25° C. [73·4–77° F.] lived as long as normal ones. In another area, however, coccidial infection of *A. philippinensis*, Ludl., was prevalent and sufficiently intense to cause death.

Candido (M.). **Présence du *Stegomyia calopus* à Bengasi.**—*Riforma med.*, 1929, p. 1661. (Abstract in *Bull. Off. intern. Hyg. publ.*, xxii, no. 6, p. 1199. Paris, June 1930.)

The distribution of *Aëdes argenteus*, Poir., in the Mediterranean Basin is discussed. At Bengasi (Cyrenaica) during an epidemic of dengue that occurred in 1928, this mosquito was not observed, though *Theobaldia* was common. In 1929 several adults of *A. argenteus* were found but no larvae, and the author considers that these mosquitos had been introduced from neighbouring countries, probably Egypt or Greece.

de Beaurepaire Aragão (H.) & da Costa Lima (A.). **Nouvelles expériences sur la fièvre jaune. Quantité de virus chez la moustique.**—*C.R. Soc. Biol.*, civ, no. 20, pp. 619–622. Paris, 13th June 1930.

Typical yellow fever was produced in monkeys (*Macacus rhesus*), inoculated with extremely highly diluted suspensions made from infected individuals of *Aëdes argenteus*, Poir. (*aegypti*, auct.), and containing less than 0·000,001 of a mosquito. A single bite of one mosquito through flannel also produced yellow fever, as did the inoculation of a dilution of the excreta of infected mosquitos. In one experiment, mosquitos transmitted yellow fever by biting through flannel 4 days after the infecting feed, but in another they failed to do so 4 or 6 days after it.

Schwetz (J.). **Les moustiques de Stanleyville (Congo belge).**—*Ann. Soc. belge Méd. trop.*, x, no. 1, pp. 25–65, 6 pls., 1 map. Brussels, 31st March 1930.

A detailed account is given of an intensive mosquito survey of Stanleyville and its environs. There are no well-marked seasons, and the mosquito fauna is practically the same throughout the year. The list of 54 species of mosquitos captured as adults or bred from larvae includes the following Anophelines: *Anopheles gambiae*, Giles, *A. marshalli* var. *moucheti*, Evans, *A. funestus*, Giles, *A. nili*, Theo., *A. mauritianus* var. *paludis*, Theo., and *A. obscurus*, Grünb. [*cf. R.A.E.*, B, xvii, 113]. The types of breeding-places in which the mosquitos were found are discussed. *A. gambiae* was found in almost all collections

of water, whether shaded or not, but more particularly in natural ones. In only one case was this species found in a cask, which seems to indicate that such reservoirs are of little importance in malaria control. When the river is high, Anophelines other than *A. gambiae* occur in the vegetation on the banks; when the river is low, this vegetation dies and *A. gambiae* is found in numbers in niches in the slabs of stone that form the river bed. Thus it is when the river is lowest and the rainfall very slight that the houses near the river are invaded by this mosquito. As soon as heavy rain begins, the larvae are swept from the rocky niches into the river and may thus disappear although the level of the river may not have risen.

Following the indications of MacGregor that the larvae of *A. funestus* occur singly among the vegetation on the banks of streams, ponds, etc. [xii, 32], the author found not only larvae of this species, but also those of *A. marshalli* var. *moucheti*, *A. nili*, and *A. mauritianus* var. *paludis*, either in association or alone, but always under the same conditions. On three occasions only larvae of *A. gambiae* were also found. The type of vegetation is of little importance provided that it gives a certain amount of shade and prevents the larvae from being washed away.

Of the mosquitos occurring in the more or less permanent rocky niches in the falls and rapids of the Congo and Chopo rivers, *Aëdes vittatus*, Big., was by far the most prevalent, being even more numerous than *A. gambiae*. A study of the species breeding in trees showed that *Aëdes argenteus*, Poir., was the most common. It was found in 90 of the 292 collections of mosquitos, and only once in association with *A. gambiae*, which seems to indicate that the habits of the two most important African species are entirely different and that the destruction of the breeding-places of one will have no effect on the multiplication of the other. The other species of Culicines found are discussed.

Adult mosquitos were usually more numerous in native huts than in the houses of Europeans. Culicines predominated in the latter, and Anophelines in the former. In certain villages *Taeniorhynchus* (*Mansonioides*) spp. were by far the most common. Adults of *Aëdes argenteus* were never found in native dwellings, although they were fairly common in the houses of Europeans.

Ottolenghi (D.) & Brotzu (G.). **Sulla sopravvivenza del virus malarico negli anofeli ibernanti.** [On the Survival of the malarial Virus in hibernating *Anopheles*.]—*Bull. Sci. Med.*, (10) iii, reprint 4 pp., 8 refs. Bologna, 1929.

Females of *A. maculipennis*, Mg. (*claviger*, auct.), caught in November 1928, were fed on two successive days on a patient experimentally infected with benign tertian malaria (*Plasmodium vivax*). They were kept in moist surroundings for two days at 24° C. [75·2° F.] and then placed in a room with free access to air and light. Every two or three days they were given the opportunity of feeding on a rabbit at a temperature of 15–18° C. [59–64·4° F.]. Only a few fed on each occasion. Apart from this, the temperature at which they were kept from mid-November to early March never rose above 12° C. [53·6° F.], often falling below 6° C. [42·8° F.] and sometimes below freezing point.

From mid-March to early April it varied between 14 and 16° C. [57·2 and 60·8° F.] and rose in May above 22° C. [71·6° F.]. Of the 100 specimens with which the experiment began, 6 survived on 8th May. These were fed on a healthy man on three successive days, and sixteen days later he developed a typical attack of spring malaria.

VAN THIEL (P. H.). **Het "Rassenprobleem" bij** *Anopheles maculipennis*. [The Problem of Races in *A. maculipennis*.]—*Acta Leidensia Sch. Med. trop.*, iv, pp. 188–190. Leyden, 1929.

Commenting on Achundow's experiments, in which differences in colour and size in *Anopheles maculipennis*, Mg., were produced by rearing the larvae in different coloured containers, and these differences were not maintained in the next generation [*R.A.E.*, B, xvii, 171, etc.], the author points out that this mosquito and its variety, *atroparvus*, van Thiel, maintained their differences of colour and size when bred under the same conditions [xvii, 83].

DE BOISSEZON (P.). **Influence de la température sur la biologie des Culicidés.**—*Bull. Soc. zool. Fr.*, lv, no. 4, pp. 255–261, 7 refs. Paris, 10th September 1930.

Laboratory experiments with *Culex pipiens*, L., showed that a blood-meal is not essential for the maturation of eggs [*R.A.E.*, B, xviii, 94]. As regards the effect of temperature, larval development takes 60 days at 10° C. [50° F.], 45 at 15° C. [59° F.] and 10 at an average of 25° C. [77° F.], if this includes nocturnal minima of 17–21° C. [62·6–69·8 °F.]. A constant temperature of 25° C., however, prevents development. At 5° C. [41° F.] development becomes very slow, with a heavy mortality, and freezing of the water causes the immediate death of the larvae. At a suitable temperature, larval development continues during winter. At 25° C. metamorphosis takes 3 days, at 15° C. 5–6 days, and at 10° C. 12 days, though at this temperature many insects are unable to emerge. Adult activity increases with the temperature, up to 25° C. Low temperatures retard oviposition, which does not occur at 5° C. At 5° C. females live 1 or 2 months, at 8–10° C. [46·4–50° F.] 2–6 months, and at 15–25° C. 15–20 days. Blood feeds considerably prolong life at all temperatures. In France hibernation appears to be due to the cessation of function in the ovaries, which results from the slowing down of the general metabolism of the insect at low temperatures. The reserves used at warmer temperatures for maturation of the eggs are thus preserved and permit the survival of hibernating females.

TEUBNER-PREDMERSKI (E.). **Das Arbeiten mit entflügelten Mücken.** [Work with de-alated Mosquitos.]—*Arch. Schiffs- u. Tropenhyg.*, xxxiv, no. 6, pp. 336–338. Leipzig, June 1930.

For convenience in laboratory work, the author cuts off the wings of mosquitos after chloroforming them. Mosquitos so treated feed and oviposit, and live for about the same time as normal ones.

LWOFF (M.). **Sur la culture de *Leptomonas fasciculata* Novy, MacNeal et Torrey 1907, Flagellé Trypanosomide.**—*C.R. Soc. Biol.*, civ, no. 21, pp. 666–668, 2 refs. Paris, 20th June 1930.

Experiments are described with various media containing blood for the culture of a strain of *Herpetomonas* (*Leptomonas*) *fasciculata* originally obtained from the hind gut of *Culex pipiens*, L., and the results are compared with those obtained in similar experiments with *H.* (*L.*) *ctenocephali* var. *chattoni* [*R.A.E.*, B, xvi, 235].

BOTSFORD (R. C.). **Mosquito Control in Connecticut in 1929.**—*Bull. Connecticut Agric. Expt. Sta.*, no. 315, pp. 608–613. New Haven, Conn., April 1930.

The work of mosquito control in Connecticut was carried on during 1929 on the same lines as in previous years [*R.A.E.*, B, xvii, 191]. Experiments were made in inland waters with the common killifish, *Fundulus heteroclitus*, which is effective in mosquito control in salt marshes, and *Rhinichthys atronasus* (black-nosed dace), but the results were inconclusive.

PERYASSÚ (A.). **O emprego de peixes na destruição das larvas de mosquitos.** [The Use of Fish in the Destruction of Mosquito Larvae.]—*A Folha medica*, xi, no. 14, pp. 160–162, 2 figs. Rio de Janeiro, 15th May 1930.

In this popular article on the use of fish against mosquito larvae, it is stated that *Astyanax rutilus* is very abundant around Rio de Janeiro and is of considerable value in this connection.

HORA (S. L.). **Ecology, Bionomics and Evolution of the Torrential Fauna, with Special Reference to the Organs of Attachment.**—*Phil. Trans. R. Soc. London*, Ser. B., ccxviii, pp. 171–282, 4 pls., 6 pp. refs. London, 1930.

An account is given (pp. 178–231) of the insects found in torrential streams in India and of their structural adaptations to their environment. The structure and habits of the Simuliids, which abound in these streams and of which very little is known, are discussed. Larvae and pupae were found in masses on a water-plant and also on the upper surface of bare rocks in clear, shallow, rapidly flowing water. The organs of attachment in the larvae are described and discussed.

ANCONA H. (L.). **Las Lemnaceas y las larvas de mosquitos.** [Lemnaceae and Mosquito Larvae.]—*An. Inst. Biol. Univ. Mexico*, i, no. 1, pp. 33–37, 5 figs., 2 refs. Mexico, 1930.

Observations in nature and in the laboratory of various Lemnaceae common in Mexico show that *Lemna* and *Wolffia*, even when forming a continuous carpet on the surface of the water, fail to prevent development of larvae of *Culex tarsalis*, Coq., and *Anopheles quadrimaculatus*, Say. *Azolla* is also ineffective under natural conditions, but if it forms a cover 7 mm. thick, the larvae of *A. quadrimaculatus* are asphyxiated. The development of both mosquitos can, however, be prevented by a mixed vegetation of *Azolla* and *Lemna gibba* with a large proportion

of *Lemna* and *Wolffia* of small size. This covering asphyxiates the mosquito larvae, but does not interfere with the useful Copepods and other crustacea. It is easily established in ponds and reservoirs.

HOFFMANN (C. C.). **Investigaciones sobre la transmission de la onchocercosis de Chiapas.** [Investigations on the Transmission of Onchocercosis in Chiapas.]—*An. Inst. Biol. Univ. Mexico*, i, no. 1, pp. 59–62, 2 figs. Mexico, 1930.

The author considers *Onchocerca caecutiens*, which infests man in Mexico and Guatemala, to be a subspecies of *O. volvulus*. The suspicion that Simuliids are its vectors was strengthened by Blacklock's discovery that in Sierra Leone *O. volvulus* is transmitted by *Simulium damnosum*, Theo. [*R.A.E.*, B, xiv, 62, 167 ; xv, 92]. In the Chiapas coffee zone of Mexico, the microfilariae have been found in blood ingested by *Simulium* (*Eusimulium*) *mooseri* and *S.* (*E.*) *ochraceum*. In both species they pass through the stomach walls to the thoracic muscles, but as yet development to the " sausage " stage has been observed by the author only in *S. mooseri*.

LE ROUX (P. L.). **Onchocerciasis of Cattle, with special Reference to its possible Life-cycle and Control.**—*Pan-Afr. Agric. Vet. Conf., Pretoria, 1929*, Papers Vet. Sect., pp. 107–112. Pretoria, Un. S. Afr. Dept. Agric., 1929. [Recd. 1930.]

The Nematodes of the genus *Onchocerca* infesting cattle in various parts of the world are listed, and the present knowledge regarding the bionomics of *O. gibsoni* is briefly reviewed. The author considers that the presence of the nodules of this parasite on the brisket of cattle strongly suggests that it is transmitted by Simuliids, which usually attack that part of the animal. *Simulium damnosum*, Theo., which is the vector of *O. volvulus* of man in West Africa, where it also attacks goats, occurs in the Transvaal, but feeds there mainly on the blood of birds. Another South African species, *S. nigritarsis*, Coq., has not hitherto been found to attack cattle. The relative scarcity of *O. gibsoni* in South Africa may be due to the preference for avian blood of the Simuliids that occur there.

The author gives notes on the rearing of Simuliids, with a view to carrying out transmission experiments with them, and suggests that methods of controlling the larvae by means of chemicals should be investigated.

BENNETT (S. C. J.). **Camel Trypanosomiasis in the Sudan.**—*Pan-Afr. Agric. Vet. Conf., Pretoria, 1929*, Papers Vet. Sect., pp. 10–15. Pretoria, Un. S. Afr. Dept. Agric., 1929.

Trypanosomiasis of camels in the Anglo-Egyptian Sudan is mainly caused by *Trypanosoma soudanense*, but outbreaks due to *T. brucei* and *T. congolense* occasionally occur, and experimentally camels have been infected with *T. vivax* and with a strain of *T. rhodesiense* from man in the southern Sudan. *T. soudanense* belongs to the *T. evansi* type, with which it seems to conform in every way, and its transmission appears to be entirely mechanical ; it occurs in areas where tsetse-flies [*Glossina*] are not found and increases at the end of the rainy season, when Tabanids are plentiful. *Tabanus taeniola*,

P. de B., which is the commonest blood-sucking fly, is believed to be the chief vector, but other species of *Tabanus*, *Pangonia* and *Stomoxys* probably play some part in the transmission of the disease. Camel transport is rarely used in the areas infested by *Glossina*, and consequently tsetse-borne trypanosomiasis is not common. The symptoms, diagnosis and treatment of *T. soudanense* are described, and notes are given on experimental infections with *T. brucei*, *T. congolense*, *T. vivax* and *T. rhodesiense*.

JACK (R. W.). **Some Aspects of the Tsetse Fly Problem in a Colony developing on the Basis of European Settlement.**—*Pan-Afr. Agric. Vet. Conf., Pretoria, 1929*, Papers Vet. Sect., pp. 16–22. Pretoria, Un. S. Afr. Dept. Agric., 1929.

In Southern Rhodesia, the continued spread of *Glossina morsitans*, Westw., on a front more than 600 miles in length, is a serious menace to the future development of the Colony. Almost all the land available for new settlement, which is greatly needed, is potential fly country, and in more than one district settlers have come in contact with the fly, and the consequent loss of stock has led to the actual or threatened evacuation of farms. The natives, at present, have no need for expansion of territory ; those inhabiting potential fly country are accustomed to living without cattle, since scarcely a generation has passed since it was previously occupied by *G. morsitans*, and they are not usually willing to leave the areas in which their villages are when these are again invaded by the fly. It is therefore the protection of areas in European occupation that is considered most urgent. In this respect the situation in Southern Rhodesia differs from that in other parts of tropical Africa.

Several methods of controlling *G. morsitans* that have been used with success elsewhere are not suited to the conditions in Southern Rhodesia. Experiments with organised late grass fires have given discouraging results [*R.A.E.*, B, xviii, 85], the grass over much of the fly country being too scanty for burning to be satisfactory. Complete clearing of forest is not a practicable means of reclaiming infested areas in Southern Rhodesia, on account of the labour involved, and even the clearing of barrier zones appears to offer almost insuperable difficulties. An attempt to render mopane forest unsuitable for *G. morsitans*, by cutting down the evergreen trees and thus destroying all shade during the hottest months of the year, was begun in 1928, but was abandoned because progress was slow and the destruction of timber involved was considered undesirable. In the apparent absence of a practicable alternative, game reduction has been resorted to and is being carried out in several districts and under various conditions, and the indications so far are that this measure checks the advance of the fly and causes some retrogression.

Although reasonably compact agricultural settlement has the effect of driving out the game, to some extent, from the area actually occupied, incursions of the fly extend for a considerable distance, in some cases as much as 20 miles, beyond the borders of the infested country. In an indefinite area that appears to surround all definite fly areas, cattle may contract trypanosomiasis comparatively freely, but no fly centres can be located. Efforts in Southern Rhodesia are therefore being

concentrated on creating and maintaining zones approximately free from game, extending for 10 miles and more beyond the farm boundaries.

TAYLOR (E. L.). *Liponyssus sylviarum* **injuring Poultry in this Country.**—*Parasitology*, xxii, no. 3, p. 313, 2 refs. Cambridge, 30th July 1930.

In October 1929 poultry on a farm in Dorset were found to be infested with *Liponyssus sylviarum*, C. & F., which has only once before been reported as a pest in the British Isles [*R.A.E.*, B, xii, 51]. No mites could be found hiding in the poultry houses, in the nesting boxes or on the eggs [*cf. R.A.E.*, B, xvii, 163]. The perches were treated with nicotine sulphate and kerosene. The mites disappeared after a second treatment, and all the birds recovered, though some had been severely affected by the infestation.

VAN THIEL (P. H.). *Trombicula flui* **n. sp., a Patatta-mite ("Patatta-luis") of Surinam.**—*Parasitology*, xxii, no. 3, pp. 346–354, 2 figs., 13 refs. Cambridge, 30th July 1930.

A. C. Oudemans has suggested that *Trombicula irritans*, Riley (*Microthrombidium tlalsahuate*, Murray) or *T. helleri*, Oud., which was described from a Lamellicorn, *Passalus* sp., and doubtfully recorded from man in Dutch Guiana, may be synonymous with *Acarus batatas*, L., described from man in the same country. As the name *A. batatas*, however, applies to a doubtful species, its use would cause unnecessary confusion. *T. flui*, sp. n., is described from larvae infesting man in Dutch Guiana, and the characters distinguishing the larvae of the American species of *Trombicula* are given.

PAPERS NOTICED BY TITLE ONLY.

VAN THIEL (P. H.). **La nourriture des larves de** *l'Anopheles maculipennis* **en rapport avec le problème de l'existence de la variété** *atroparvus*.—*Acta Leidensia Sch. Med. trop.*, iv, pp. 131–187, 41 refs. Leyden, 1929. [See *R.A.E.*, B, xvii, 83.]

PINTO (C.). **Mosquitos da região neotropica (Brasil, Estados de S. Paulo e Rio de Janeiro). II.** *Psorophora geniumaculata* **e** *P. ciliata* **(Diptera: Culicidae).**—*Mem. Inst. Oswaldo Cruz*, xxiii, no. 4, pp. 179–184, 6 pls. Rio de Janeiro, 1930.

MANALANG (C.). *Phlebotomus manganus*, **a new Sand Fly from the Philippines.** *Phlebotomus hitchensi*, **a new Philippine Species.** *Pilecotomus heiseri*, **a new Philippine Species.** *Philipp. J. Sci.*, xlii, no. 2, pp. 283–289, 1 fig.; 291–297, 1 fig.; 299–305, 1 fig. Manila, June 1930.

KEILIN (D.) & NUTTALL (G. H. F.). **Iconographic Studies of** *Pediculus humanus*.—*Parasitology*, xxii, no. 1, pp. 1–10, 18 pls., 22 refs. Cambridge, January 1930.

Graham-Smith (G. S.). **Further Observations on the Anatomy and Function of the Proboscis of the Blow-fly,** *Calliphora erythrocephala*. —*Parasitology*, xxii, no. 1, pp. 47–115, 4 pls., 36 figs., 12 refs. Cambridge, January 1930.

Bourguignon (G. C.). **Myiase cutanée à** *Lucilia madagascariensis* [Macq.] **du canard domestique à Coquilhatville** [Belgian Congo].—*Ann. Soc. belge Méd. trop.*, x, no. 1, pp. 81–83, 1 pl. Brussels, 31st March 1930.

Cousin (G.). **Le développement endoparasitaire de la larve ectoparasite de** *Mormoniella vitripennis* **Walk.** –*C.R. Acad. Sci. Fr.*, cxc, no. 25, pp. 1530–1532. Paris, 1930.

Keilin (D.) & Tate (P.). **On certain semi-carnivorous Anthomyid Larvae.**—*Parasitology*, xxii, no. 2, pp. 168–181, 1 pl., 5 figs., 7 refs. Cambridge, 24th March 1930.

Sikes (E. K.). **Larvae of** *Ceratophyllus wickhami* **and other Species of Fleas** [*C. fasciatus*, *Xenopsylla cheopis* and *X. astia*].—*Parasitology*, xxii, no. 2, pp. 242–259, 7 figs., 33 refs. Cambridge, 24th March 1930.

Ferris (G. F.). **Some African Diptera Pupipara** [Hippoboscids and Streblids].—*Parasitology*, xxii, no. 3, pp. 275–282, 6 figs. Cambridge, 30th July 1930.

Jobling (B.). **A Revision of the Genus** *Raymondia* **Frauenfeld (Diptera Pupipara, Streblidae).**—*Parasitology*, xxii, no. 3, pp. 283–301, 10 figs., 10 refs. Cambridge, 30th July 1930.

Pavlovsky (E. N.). *Ornithodorus papillipes* **Birula** [=*crossi*, Brumpt] **and** *O. cholodkovskyi* **n. sp.** [Turkestan].—*Parasitology*, xxii, no. 3, pp. 355–360, 1 pl., 17 figs., 2 refs. Cambridge, 30th July 1930.

Schulze (P.). **Erster Beitrag zu einer Zeckenfauna Schwedens.** [First Contribution to a Tick Fauna of Sweden.]—*Göteborgs K. Vetensk. Samh. Handl.*, (5) B.1, no. 13, 18 pp., 18 figs., 8 refs. Göteborg, 1930.

Schulze (P.). **Ueber einige Verwandte von** *Ixodes ricinus* **L. aus Ostasien.** [Species allied to *I. ricinus* in E. Asia.]—*Zool. Anz.*, xc, no. 9–12, pp. 294–303, 10 figs., 7 refs. Leipzig, 1930.

Weiss (A.). **Sur un nouvel Aphaniptère (Syphonaptère) du genre** *Stenoponia*: *St. insperata* **nov. sp.** [on Rodents in Tunisia].—*Bull. Soc. Hist. nat. Afr. N.*, xxi, pp. 65–73, 2 pls., 2 figs. Algiers, 1930.

Stewart (M. A.). **New Nearctic Siphonaptera.**—*Canad. Ent.*, lxii, no. 8, pp. 175–180, 1 pl. Orillia, Ont., August 1930.

Ries (E.). **Ueber die Symbionten der Läuse und Federlinge.** [The Symbionts of Anoplura and Mallophaga.]—*Zbl. Bakt.*, (I, Orig.) cxvii, no. 4–5, pp. 286–298, 8 figs., 18 refs. Jena, June 1930.

Kröber (O.). **Neue Tabaniden und Zusätze zu bereits beschriebenen.** [New Tabanids and Additions to some already described.]—*Zool. Anz.*, xc, no. 3–4, pp. 69–86, 21 figs. Leipzig, 1st August 1930.

Hoffmann (C. C.). **Un** *Simulium* [*avidum*, sp. n.] **nuevo de la zona cafetera de Chiapas.**—*An. Inst. Biol. Univ. Mexico*, i, no. 1, pp. 51–53, 4 figs. Mexico, 1930. [*Cf. R.A.E.*, B, xviii, 213.]

JACK (R. W.). **Tsetse Fly.**—*Rep. Secy. Dept. Agric. S. Rhodesia, 1929*, pp. 46–50. Salisbury, 1930.

The continued spread of *Glossina morsitans*, Westw., in Southern Rhodesia and the consequent menace to settlement has necessitated not only the continuance and extension of operations in progress at the beginning of the year [*R.A.E.*, B, xvii, 211] but also the inauguration of operations elsewhere. Intensive and costly operations along the whole line are impracticable, and it is only in comparatively short sectors, where the fly is either causing loss to farmers or, by its steady advance, threatening occupied territory, that the position justifies vigorous efforts to check it sufficiently to place the farms outside the danger zone. Experience has shown that vigorous and sustained operations against game in defined zones have an early effect in arresting the advance of the fly, although for a limited period they may serve to extend the ranging of scattered individuals.

The operations in the Lomagundi area that were begun in January 1926 have been prosecuted throughout the year both in the originally fenced area and in an extension of similar width on the northern side, that is, over a zone 20 miles wide adjacent to occupied territory. The general improvement in the position with regard to the health of the cattle in the occupied area has been maintained on the whole, though trypanosomiasis occurred on several farms. Definite operations against game in the newly fenced area were begun in June 1928 and resulted in a very great reduction in density of adult flies throughout the area. Examination of the gut contents of flies from within the area revealed an insignificant increase in the percentage of avian as compared with mammalian blood.

In the Gatooma sub-district, where the eastern game fence has been extended, the uniform and comparatively dense nature of the forest, the large extent of semi-thicket, and the scanty supply of permanent water, renders the problem of game elimination more difficult. The encroachment of the definite fly area, which had previously been extending eastwards very rapidly, appears to have been arrested, but a number of additional farms have sustained losses during the year and the position has been very unsatisfactory. A transition period of this nature has, however, occurred in all instances where intensive hunting of game has been carried out and also in one case where intensive deforestation of a fly area close to settlement has taken place. Wider ranging of the fly is probably the natural sequel to any fundamental interference with environmental conditions. Great and rapid fluctuations in fly density within the fenced area appear to support the view that large movements of fly generated outside the area have been taking place within it. The spreading of the fly having outflanked the fenced area, a flanking fence was erected towards the end of the year and operations were extended into a fresh area adjacent to the Umfuli River and east of the present fence.

Inspection of territory in Portuguese East Africa near the Melsetter border [*cf.* xvii, 211] failed to reveal fly south of Spungabera, though *G. pallidipes*, Aust., and *G. brevipalpis*, Newst., were found in abundance to the north. Definite indication was obtained of an advance towards the border in the wet season.

The measures undertaken have been mainly directed towards the protection of European settlement, but in order that the natives should be given the opportunity of protecting the country occupied by

them from the encroaching fly, a cordon of game reduction areas along the whole limit of the fly country is being maintained, in which certain natives are allowed to hunt.

POMEROY (A. W. J.). **The Tsetse Problem and Trypanosomiasis on the Eastern Cattle Route in the Gold Coast.**—*Rep. Med. Sanit. Dept. Gold Coast 1928–29*, pp. 67–73. Accra, 1929. [Recd. 1930.]

Various species of *Glossina* are widely distributed throughout the Gold Coast Colony and the Protectorates of Ashanti and the Northern Territories, but though there are undoubtedly centres of human and animal trypanosomiasis, the disease does not appear to be so virulent or to cause the loss to man and animals occasioned in some other parts of Africa. The population in most of the endemic areas is so small that tsetse control measures are almost impossible.

The practicability of controlling the fly on the main cattle route from French Territory was investigated from November 1926 to March 1929. The bulk of the meat supply of the Gold Coast comes from the Haute Volta, and 40,000 head of cattle are imported yearly, most of which pass down the eastern route through the Northern Territories to Kumasi, Ashanti, a distance of about 340 miles from the border. The ultimate market value of this import is nearly £500,000. The cattle are nearly all of the Zebu or large-humped type, which is very susceptible to trypanosomiasis, and the loss in weight and quality of the meat due to the rigour of the journey and the effects of the disease, as well as the actual mortality, are of economic importance. In order to determine whether most of the infections took place in French Territory or later, blood examinations were made at the border, half-way down the route and at Kumasi. During the dry season, when the bulk of the cattle is imported, the rate of infection at the border was remarkably low, and an increase of as much as 60 per cent. took place during July at Kumasi. During the rains in August comparatively few cattle are imported and there is a sudden rise in the rate of infection, probably because the animals have been kept for some time in a tsetse-infested area prior to importation. Soon after leaving the French border, the cattle begin to pass through tsetse belts and become increasingly infected with trypanosomiasis as they proceed southwards.

The fly belts are well defined and are confined to the fringing vegetation of the rivers and streams. *G. palpalis*, R.-D., appears to be restricted to the tall vegetation and fringing shade of rivers and small streams, which, except in the case of the Volta, seldom extends for a width of more than twenty yards along the banks. During the dry season, from the end of October to the end of May, the streams dry up until the beds consist of a series of pools enclosed by overhanging banks, the bases of which are usually sandy, and the fallen trunks and logs afford ideal breeding-places for the fly. During the rains, the streams rise rapidly and frequently flood the surrounding country for some miles. Breeding takes place intermittently during the dry weather and definitely increases with the first rains in May. There is usually a period of comparatively dry weather between the beginning of the rains and the true rainy season, and it is apparently during this period that the bulk of the flies is produced; these flies survive until the floods subside and breeding grounds are again available. From

observations at river crossings on the route, it appears that the clearing of shade trees for 500 yards on either side of a stream should reduce attacks to negligible proportions. *G. palpalis* may be found at every stream crossing, but these are not very numerous on the northern half of the route, and the area to be cleared works out at about 32 acres at each point.

G. tachinoides, Westw., is associated with the same environment, and although it is undoubtedly found further from its breeding-places than *G. palpalis*, it is essentially a riverine species on the cattle route and could be restricted by the same clearing measures.

Formerly the main north road, which runs adjacent to the cattle route for many miles, was undoubtedly infested with *G. morsitans submorsitans*, Newst., but continuous motor traffic has driven away the game and this fly has consequently disappeared. Certain districts to the west appear to be heavily infested with it, but in these areas game is very prevalent and the population extremely sparse.

G. medicorum, Aust., inhabits the dense shade of the thickets and tall trees fringing the River Volta, the pupae occurring under large logs in association with those of *G. palpalis*. Thirty to forty individuals have been taken from time to time in six months. It has been found following the cattle for ¾ mile, but it is local in its distribution and has never been known to leave the dense shade to attack except when following cattle that had been resting there. *G. longipalpis*, Wied., and *G. caliginea*, Aust., are rare on the cattle route. *G. fusca*, Wlk., and *G. nigrofusca*, Newst., are present in the rain forest belt.

Game is abundant in only two localities on the route, but a continual food supply for the flies is maintained by the passing cattle and the thousands of labourers who migrate from French territory during the cacao season and return later in the year.

The minimum pupal period for *G. palpalis* and *G. tachinoides* bred in the laboratory during the rainy season was 19 and the maximum 46 days, the males taking on an average slightly longer to emerge than the females.

The possible importance of endemic areas of sleeping sickness on main trade routes is pointed out. In one locality 6½ per cent. of the population were found to be infected with trypanosomiasis, and thousands of migrating natives rest at this point before dispersing into the remote parts of the forest of Ashanti. The country surrounding is open and free from tsetse, but *G. palpalis* and *G. tachinoides* were found to occur along the river and small streams. By careful and systematic clearing the infestation should be completely controlled at a reasonable cost.

Robinson [G.]. **The Tsetse Problem and Trypanosomiasis on the Eastern Cattle Route in the Gold Coast.** –*Rep. Med. Sanit. Dept. Gold Coast 1928-29*, pp. 74–82. Accra, 1929. [Recd. 1930.]

A detailed account is given of the blood examinations of cattle carried out at three places on the eastern cattle route [see preceding abstract]. Mature trypanosome infections were found in flies at 6 places on the route. During the rains, when the flies are more numerous, more flies become infected and the infection rate in cattle is consequently higher.

The most prevalent species were *Glossina tachinoides*, Westw., and *G. palpalis*, R.-D. The former was usually more numerous, and its

rate of infection was almost always higher. A table is given showing the mature infections found in these two species at various localities on the cattle route during 1928–29. The parasites most frequently encountered were of the *Trypanosoma vivax* group. Of 21 individuals of *G. morsitans submorsitans*, Newst., one showed a mature infection of the *T. vivax* group and of 30 individuals of *G. medicorum*, Aust., one showed mature infection with the *T. congolense* group, one showed *T. congolense* in the gut only, and two others mature infections of the *T. vivax* group.

Experiments were made to determine the development of trypanosomes of the *T. vivax* group in the fly. Of 82 individuals of *G. tachinoides* fed on animals infected with *T. vivax*, 10 showed mature infections. Parasites were first found in the hypopharynx 5 days after the infecting feed. Of 14 flies dissected on the 7th day, four were fed on an uninfected animal on the day of dissection. Two of these showed mature infections and the animal showed *T. vivax* in the peripheral blood 11 days later. Of 32 individuals of *G. palpalis* fed in the same manner, 6 showed mature infections. The hypopharynx became infected on the 5th day. An infected fly dissected on the 11th day was first fed on an uninfected animal; *T. vivax* appeared in the peripheral blood 10 days later. Two individuals of *G. medicorum* fed on a sheep showing numerous *T. vivax* in the peripheral blood, were dissected on the 6th day after the first feed, and one showed a mature infection of the *T. vivax* group. One individual of *G. medicorum* fed on a rat showing *T. brucei* in the peripheral blood was dissected on the 9th day and showed parasites in the gut and proventriculus, the proboscis and salivary glands being negative.

DAUBNEY (R.). **Natural Transmission of Heart-water of Sheep by *Amblyomma variegatum* (Fabricius 1794).**—*Parasitology*, xxii, no. 2, pp. 260–267, 1 pl., 3 charts, 7 refs. Cambridge, 24th March 1930.

Amblyomma hebraeum, Koch, the vector of heartwater in South Africa, has not been recorded from Kenya Colony, although the disease is widely distributed throughout the Highlands [*cf. R.A.E.*, B, xviii, 101], but *A. gemma*, Dön., which morphologically resembles it more closely than any other species, has not infrequently been collected from cattle, sheep and goats from farms infected with heartwater, though usually in small numbers and invariably in association with *A. variegatum*, F., which is much more common in the same districts. Neither of these ticks occurs in South Africa. Although *A. gemma* is a possible vector, its comparative rarity relegates it to a position of secondary importance. *A. variegatum* has been suspected of transmitting heartwater in Kenya, but owing to the difficulty of rearing it in the laboratory, definite proof has been difficult to obtain. However, two sheep and a cow died between 27th June and 5th August 1929 of naturally contracted heartwater in a small fenced enclosure at the laboratory, and adults of *A. variegatum* were taken on each animal after death. As no cases of heartwater had occurred elsewhere on the laboratory farms and *A. variegatum* cannot normally be collected from the laboratory animals, it was concluded that two cattle that had occupied the enclosure in the previous March and had died apparently of the sequelae of rinderpest and of African coast fever respectively,

had in all probability been responsible for the infestation of the enclosure by dropping engorged nymphs. The possibility that one or both of these animals were infected with heartwater at the time of death cannot be excluded, as histological examinations for *Rickettsia* or heartwater lesions were not carried out. The time elapsing between the arrival of these animals and the occurrence of the first case of heartwater (125 days) is presumably the time required by the nymphs to moult, feed and produce infection.

No immature ticks were found on calves placed in the paddock after the death of the two original cattle and examined once or twice daily, but 12 unfed adults were thus collected in two weeks, after which the supply was apparently exhausted. Four unfed individuals of *A. variegatum* (3 males and 1 female) were placed on each of two sheep, both of which reacted on the 20th day. Both sheep recovered, but heartwater was transmitted to other animals by inoculation of blood from the one that had reacted most severely. Thus heartwater in Kenya may be transmitted naturally by adults of *A. variegatum*. The incubation period after infestation with infected ticks is about 3 weeks; after direct blood inoculation from a reacting animal it is usually 9–12 days. The findings of Cowdry [xiv, 213] with reference to the regular occurrence of *Rickettsia* in animals experimentally infected with heartwater are confirmed, the organism found in these experiments agreeing morphologically with *R. ruminantium*.

Basu (B. C.). **On the Rôle of *Argas persicus*, in the Transmission of *Pasteurella avicida*.**—*Ind. Med. Gaz.*, lxv, no. 6, pp. 326–327, 4 refs. Calcutta, June 1930.

Pasteurella avicida is the causal organism of chicken cholera or fowl plague, a disease that affects poultry in sudden epidemic form. Birds fed on the smallest drop of a recent culture of the micro-organism become infected, and the excreta of infected birds are a cause of contagion to healthy fowls.

In experiments in Calcutta in 1928 eight healthy fowls were made to ingest examples of *Argas persicus*, Oken., that had been fed 1–20 days previously on infected birds. One died the next day, but of the other seven, two became infected, one 3 days after swallowing 30 ticks that had fed 4 days previously on an infected bird, and the other on the second day after ingesting 50 ticks fed 1 day previously. Fowls thus infected lived as long as 7 days after the first appearance of infection, whereas those inoculated intravenously usually die within 6 hours of the injection. Fowls in nature are in the habit of picking up and eating ticks, so that it appears possible that the disease may be acquired in this manner. On the other hand, naturally acquired infections are apt to be extremely virulent and to kill immediately. It would therefore appear that there is some loss of virulence of *P. avicida* in the gut of the tick.

Experiments were also carried out with *Cimex hemiptera*, F., which is frequently found in fowl houses and feeds readily on fowls. None of 3 healthy birds became infected after swallowing bugs fed 1–3 days previously on diseased birds.

Further tests were undertaken to find whether either of these ectoparasites could convey infection by biting. Of 7 fowls on which ticks,

fed from 1–41 days previously on diseased birds, were allowed to feed, only one became infected, the incubation period being two days. This bird had been bitten by ticks infected 14 days previously. Neither of two healthy fowls on which *C. hemiptera*, fed 3 days previously on diseased ones, was allowed to feed contracted the disease.

The most striking characteristic of fowl cholera epidemics is their suddenness. *P. avicida*, which does not form spores, is easily killed by desiccation, by heating to 55° C. [131° F.], by antiseptics and by very dilute acids. Thus it is not likely to survive long in the faeces of infected birds under ordinary conditions of temperature and humidity. It is suggested that infection may persist in the off-season in the invertebrate host, *A. persicus*, and that an epidemic may be started by the ingestion of infected ticks, although its subsequent rapid spread is due to contaminative infection.

SIKES (E. K.). *Bairamlia fuscipes* **Waterston, a Chalcidoid Parasite on** *Ceratophyllus wickhami* **Baker (Siphonaptera).** -*Parasitology*, xxii, no. 3, pp. 361–369, 4 figs., 7 refs. Cambridge, 30th July 1930.

The larval and pupal stages of the Miscogasterid, *Bairamlia fuscipes*, Watrst. [*cf. R.A.E.*, B, xvii, 182] were found in the cocoons of *Ceratophyllus wickhami*, Baker, in Buckinghamshire, and the adults were observed crawling about in the nest of the grey squirrel (*Sciurus carolinensis*). Only 7 per cent. of the flea cocoons dissected at intervals during 15 months were parasitised. *B. fuscipes* was not reared in the laboratory beyond the second instar, though full-grown larvae successfully reached maturity. The female oviposits through the cocoon of the flea and fixes the egg on the abdomen of the resting larva or pupa. Only one egg was found in each parasitised cocoon. The larva feeds externally on the flea larva. Attempts to parasitise the larvae of *Xenopsylla astia*, Roths., were unsuccessful. The external anatomy of the full-grown larva of *B. fuscipes* is described.

VAN THIEL (P. H.). **De " Patatta-luis " uit Suriname, met aanteekeningen omtrent de aetiologie der Leishmaniosis americana.** [The " Patatta " Mite in Dutch Guiana with Notes on the Aetiology of American Leishmaniasis.]—*Geneesk. Tijdschr. Ned.-Ind.*, lxx, no. 1, pp. 47–63, 2 figs., 28 refs. Weltevreden, 1st January 1930.

A historical note is given on the harvest mite known in Dutch Guiana as the " patatta " mite, which name the author considers to be a collective term, probably including *Trombicula helleri*, Oud., and *T. flui*, van Thiel [*cf. R.A.E.*, B, xviii, 215]. The possible connection of the mites with various diseases in Dutch Guiana is discussed. The itching they cause induces scratching that in turn results in the various severe leg infections common there. The mites have been suspected of transmitting dermal leishmaniasis, of which, however, *Phlebotomus squamipennis*, Lutz & Neiva, seems a more likely vector. It also appears unlikely that *T. irritans*, Riley, is responsible for the spread of tabardillo (Brill's disease) in Mexico [*cf. R.A.E.*, B, xvii, 228, etc.].

Hirst (S.). **On the larval Trombidiid Mite (*Trombicula hirsti* L. Sambon) that causes the "Scrub Itch" of Northern Queensland and the Coorong, South Australia.**—*Trans. Roy. Soc. S. Australia*, liii, pp. 24–26, 1 fig. Adelaide, 1929. [Recd. 1930.]

Numerous larvae of *Trombicula hirsti*, Sambon, which was described from North Queensland [*R.A.E.*, B, xvi, 19], and also attacks man in the south-east of South Australia [*cf.* xvii, 111], were collected in December 1928 in the latter area, where they are extremely abundant during the warmer months. The larvae are chiefly found in undergrowth beneath "tea" trees, and persons walking among these trees are often severely attacked. This mite is almost certainly identical with *T. pseudoakamushi*, Hatori [viii, 37], but this name has been used for another species by Tanaka. Further investigation of the Japanese literature is necessary before the correct name can be definitely settled [*cf.* xviii, 185]. The species occurs in Japan, Sumatra and the Malay Peninsula, but has not yet been found to transmit disease, although *T. akamushi*, Brumpt, and *T. deliensis*, Walch, are known to transmit various forms of typhus-like fever. Another species, *T.* (*Leeuwenhoekia*) *australiensis*, Hirst, attacks man in New South Wales [xiii, 190], and is also known to occur in Sumatra [*sic*? Celebes, *cf.* xvi, 110]. Descriptions are given of the larvae of *T. hirsti* and *T.* (*Schöngastia*) *coorongensis*, sp. n., which was found in the same district of South Australia, in the ears of a rat, *Mus* (*Rattus*) *lutreola*.

Rivnay (E.). **Technique in artificial Feeding of the Bed Bug, *Cimex lectularius* L.**—*J. Parasit.*, xvi, no. 4, pp. 246–249, 1 fig., 4 refs. Urbana, Ill., June 1930.

Investigations have shown that heat is the only agent that attracts *Cimex lectularius*, L., and stimulates its desire to feed. It will not attack any object that is moist or has a repellent odour or too smooth a surface, and will not feed on any exposed liquid. The author induced both adult and immature bugs to feed artificially by the following method. A tender piece of chicken skin, which had been in the refrigerator for several days, was stretched and the adipose tissue carefully scraped off; it was then spread over one end of an open glass tube, tied with a string and dried with blotting paper. Down the other end of the tube was poured serum obtained from fresh chicken blood and slightly heated to prevent coagulation and hardening. The tube was then placed, covered end downwards, in a petri dish containing the bugs, all of which fed to their fullest capacity. Warm chicken broth and dilute sugar solution were also taken in this manner.

Czarkowska (J.) & Blank-Weissbeg (S.). **The Rôle of the Bed-bug (*Cimex lectularius*) in the Transmission of Relapsing Fever.** [*In Polish.*]—*Medycyna doświadczalna i społeczna*, xii, no. 1–2, pp. 110–118, 7 refs. Warsaw, 1930. (With a Summary in French.) (Abstract in *Trop. Dis. Bull.*, xxvii, no. 9, p. 699. London, September 1930.)

The spirochaetes are found in the anterior part of the alimentary canal of *Cimex lectularius*, L., up to 46 days after an infecting feed. They become motionless 24–48 hours after being ingested, but retain their form. Very active spirochaetes appear in the haemolymph

6 to 7 days after infection, which may indicate some evolution. The injection of infected bed-bugs up to the 15th day, and also of haemolymph containing spirochaetes, produces infection in mice.

KEMPER (H.). **Beiträge zur Biologie der Bettwanze** (*Cimex lectularius* **L.) I. Ueber den Einfluss des Nahrungsmangels.** [Contribution to the Biology of *C. lectularius*. I. The Effect of Food Deficiency.]—*Z. Morph. Oekol. Tiere*, xix, no. 1, pp. 160–183, 4 figs., 30 refs. Berlin, 14th August 1930.

A detailed account is given of the results of experiments on the effects of insufficient food on development, oviposition and survival in *Cimex lectularius*, L. The length of time that any stage can live without food is lessened by raising the temperature and increased by lowering it. The average and maximum periods of survival in weeks at 22° C. [71·6° F.] were 5 and 10 for unfed first instar larvae, and for fed individuals subsequently starved 10 and 19 in the first instar, 16 and 35 in the second and third, 19 and 37 in the fifth, 20 and 32 in young adult females, and 20 and 38 in young adult males. Total lack of food prevents further development or oviposition.

Department of Entomology and Zoology.—*Ann. Rep. Tech. Serv. Dept. Agric. Haiti, 1928–29*, Bull. no. 17, pp. 157–166, 5 figs. Port-au-Prince, Haiti, 1929. [Recd. 1930.]

Bed-bugs [*Cimex lectularius*, L.] were effectively controlled in a large building in Haiti by fumigation with calcium cyanide dust, spread on papers on the floor, at the rate of 2 lb. to 1,000 cu. ft. of space. The doors and windows were sealed with paper, and all bugs were killed even in the centre of mattresses or in deep cracks in the walls.

A spray recommended for destroying mosquitos, etc., consists of 1 U.S. gal. petrol, 2 lb. pyrethrum, 1 U.S. pint carbon tetrachloride, and 1 oz. oil of peppermint.

HEGNER (R.), ROOT (F. M.) & AUGUSTINE (D. L.). **Animal Parasitology with special Reference to Man and domesticated Animals.**—Demy 8vo, xxi+731 pp., 280 figs. New York & London, The Century Co., 1929. Price $6.50. [Recd. 1930.]

This textbook, which endeavours to bring up to date the present state of knowledge respecting parasitology in man and animals, necessarily covers a wide field. The subject matter has, however, been well selected, and descriptions of all the more important parasites are given, together with details of their relations with their hosts.

The introduction, on parasitism in animals in general, and the first section, on protozoology, are written by the senior author, and the second section, on helminthology, is by Dr. Augustine.

The third section, on medical entomology, by Dr. Root, occupies nearly one-fourth of the book. A general account is given of all the Arthropods concerned in the transmission of disease, special attention being directed to those found in the Western Hemisphere, more particularly the mosquitos. Many of the text figures in this section are original.

An important feature of the book is the classified bibliography, which occupies 57 pages.

Kligler (I. J.). **The Epidemiology and Control of Malaria in Palestine.** —Med. 8vo, xv+240 pp., 22 maps, 32 figs., 48 refs. Chicago, Ill., Univ. Chicago Press; London, Camb. Univ. Press, March 1930. Price $5.00; 22*s.* 6*d.*

This book reviews the anti-malarial work done in rural districts in Palestine during 1921–27 (a good deal of which has been noticed from other sources), which has resulted in practical control of the disease throughout the country. The conditions in Palestine bearing upon the malaria problem are fully described, and the bionomics of the Anophelines present are discussed in detail, with a consideration of the incidence and epidemiology of the disease. The methods of control are reviewed with reference to local conditions, and the value of Paris green as a larvicide is emphasised. The larvicidal fish, *Gambusia*, has been successfully introduced from the United States, and native species of *Cyprinodon* and *Tilapia* have also been used, the latter with good effect.

The anti-mosquito measures that have been practised almost continuously for from four to six years have produced in most areas a steady downward tendency in malaria incidence. Demonstrations of the first year's preliminary work in highly malarious localities showed a reduction ranging from 82 to 91 per cent., at an annual cost per head of 6–10*s.* The work was subsequently extended to cover some 300 square miles, comprising a population of 40,000, the average cost per head being 2*s.* The efficiency of the control varied somewhat from year to year, as a result partly of differences in thoroughness of work and partly of factors that still remain unknown in the epidemiology of malaria. There is a long breeding season of Anophelines and two distinct malaria periods, June–August and October–December; the long, dry season also renders irrigation necessary, thus creating another problem. *Anopheles sacharovi*, Favr (*elutus*, Edw.), *A.* (*Myzomyia*) *sergenti*, Theo., and *A.* (*M.*) *superpictus*, Grassi, are all important vectors of malaria in Palestine, so that small brooks and overgrown irrigation canals, where the two latter breed, are of as much significance as the extensive, stagnant marshes harbouring *A. sacharovi*. The zone of anti-larval operations is considered of the greatest importance; this should extend to the effective range of dispersion of the mosquitos during the active breeding season. The invasion at the end of the season can be counteracted by systematic destruction of adult mosquitos, which can be effected in houses, stables, etc., by capture, spraying (which is not very effective) and fumigation.

Kumm (H. W.). **The geographical Distribution of the Malaria carrying Mosquitoes. A Collection of recorded Material in the Literature and in personal Communications to the Author.**—*Amer. J. Hyg.*, Monog. Ser., no. 10, 178 pp., 39 maps, 397 refs. Baltimore, Md., 1929. [Recd. 1930.]

This work constitutes a list of the mosquitos involved in the transmission of malaria throughout the world, with details of their synonymy and geographical distribution. Certain species that have at times been suggested as possible malaria carriers, but are not apparently of major importance, have been omitted. The most widely distributed of the

Anophelines is *Anopheles maculipennis*, Mg., which extends from Europe, over North Africa, Asia Minor and Siberia to Alaska, Canada and the United States.

It is pointed out that although the Australasian forms do not occur west of Wallace's line, which runs west of Celebes and between the islands of Bali and Lombok, nine oriental forms do extend across it eastward. Some species, although widely distributed, are only dangerous malaria carriers in certain restricted areas. *A. pseudopunctipennis*, Theo., which is the most important vector in Argentina, is apparently harmless in North or Central America; *A. maculatus*, Theo., is a very active vector in the Federated Malay States, but only of minor importance in Sumatra; and *A. ludlowi*, Theo., is much more dangerous in Sumatra than in Malaya. *A. maculipennis* does not convey malaria to the same extent in every place in which it is found.

MARSHALL (J. F.). **The Organisation of Mosquito Control Work.**—Super Roy. 8vo, 10 pp., 8 pls., 1 fig. Hayling Island, Hants, British Mosquito Control Institute [1930]. Price 9*d*.

Brief general notes are given on the bionomics of mosquitos and their relation to disease. The 26 British species, which comprise three Anophelines, are listed and their habits described. The means of collecting data on the mosquitos locally prevalent and the steps to be taken when organising a control campaign are discussed.

JAMES (S. P.). **The Disappearance of Malaria from England.**—*Proc. R. Soc. Med.*, xxiii, no. 1, pp. 71–85, 5 diag., 9 refs. London, November 1929.

In the first part of this paper the author gives reasons for considering that though malaria used to be more prevalent and severe in various parts of England in the past than it is now, its distribution was always peculiarly limited to a few localities near the coast. The supposition that the "epidemic agues" of olden times were cases of malignant tertian seems improbable owing to the fact that *Plasmodium falciparum* does not appear to be able to exist or spread under natural conditions in England. Moreover, it has been found impossible to maintain a strain of this type in the laboratory. The distribution of the areas that are still "potentially malarious" corresponds very closely to that indicated 70 years ago. In general these areas have not been converted into "non-malarious areas," as sharp and widespread outbreaks of malaria occurred among the local inhabitants when infected troops were brought to them during the war [*cf. R.A.E.*, B, viii, 125]. There has, however, been a significant reduction (in some years a complete cessation) of observed cases of the disease, and in particular a cessation of severe and fatal cases.

In the second part of the paper the author discusses the possible causes of the decline in incidence and severity. *Anopheles maculipennis*, Mg., the important vector of malaria in England, is more abundant in nearly every rural district than in many exceedingly malarious regions in tropical countries. Moreover, in a number of districts where malaria did not spread, Anophelines are more abundant than in endemic areas, so that the reduction is not due to a reduction in the numbers of the

vector. Although malaria in England is maintained partly by spread of a true indigenous strain, which the author believes has never entirely disappeared from certain areas, it is chiefly due to carriers from abroad. In the laboratory *A. maculipennis*, *A. bifurcatus*, L., and *A. plumbeus*, Steph., can act as efficient hosts of malaria parasites, but under natural conditions in England *A. maculipennis* is the only species definitely incriminated, the reason being that it is the only one living in close association with man. Except in unusual circumstances, it has never been observed biting in the open air. The factors determining the type of shelter chosen by this mosquito appear to be the presence of animals or man to serve as food, the absence of draughts, relative darkness, dampness, and a relatively warmer temperature than the open air, and the common observation that mosquitos are more abundant in cowsheds and stables than in dwellings is a consequence of the operation of these factors and in all probability is not due in any way to a selective preference for the blood of animals. For this reason the disease is more likely to spread among inhabitants of houses that fulfil these conditions than in those less attractive to mosquitos [viii, 125]. With regard to the problem of the length of time that the mosquito remains in the house, it is pointed out that if the maturation of eggs takes a week, at the end of that period the adults must seek water for oviposition. In *A. maculipennis*, egg development ceases at the end of August or early in September, so that from this time there is no reason why the insect should leave the house. This appears to be proved by observations on so-called "malarious houses" where, if one member of a family happens to be a malaria carrier, cases continue to occur at intervals for several weeks, though the disease does not spread to neighbouring dwellings. This is most likely to occur in cottages where several people sleep in one room. Under natural conditions in England mosquitos must live at least 15 days after biting an infected person in order to become infective. Adults seldom live for that length of time in May and June, but many live a long time during August, September and October [*cf.* xviii, 32].

It has been shown that individuals may be immunised against a strain of *Plasmodium*, but that resistance breaks down when they are exposed to another species or even another strain of the same species. Thus in an isolated village where benign tertian malaria is prevalent, the inhabitants quickly become tolerant of their own strain. This supports the view that the peculiar distribution of malaria in England and the rise and fall of incidence in endemic centres is defined and decided essentially by the importation of new cases of the disease and new strains of the parasite. Recent experience has shown that when the importation of new cases ceases, or when imported cases are immediately treated with quinine, the disease soon loses its importance, thus justifying the view that the influence of the human source of infection in maintaining a condition of malarial endemicity in England is greater than the influence of the insect carrier or of environment. At all seasons the relative humidity in all parts of England is favourable to the development of the parasite in the mosquito, and though temperature is probably not so in the open, except in July and August, the only conditions of significance are those of the interior of the dwellings, cowsheds, etc., in which the mosquito shelters.

A study of intentional infections for therapeutic purposes has shown that benign tertian malaria untreated by quinine is often a serious disease, which, in patients enfeebled from any cause, not infrequently

results fatally. In an epidemic in Kent in 1917 a surprisingly large number of cases occurred until quinine treatment was instituted, when the epidemic ceased. Thus it seems probable that quinine was one of the most important factors in causing the reduction in the fatality and incidence of malaria.

It is concluded that the diminution of local malaria in England has been due to progressive improvements of a social, economic, educational, medical and public health character. Thus the correct way of beginning to combat malaria in its endemic areas is to introduce agricultural schemes that aim primarily at improving the economic prosperity of the people, but are accompanied by progressive arrangements for adequate medical attention, education, housing, etc. [*cf.* xv, 197].

DE BUCK (A.), SCHOUTE (E.) & SWELLENGREBEL (N. H.). **Racial Differentiation of *Anopheles maculipennis* in Netherlands and its Relation to Malaria.** —*Riv. Malariol.*, ix, no. 2, pp. 97–110, 2 figs., 15 refs. Rome, 1930. (With Summaries in Italian, p. 201, French, p. 203, English, p. 205, German, p. 207.)

Two new characters, relating to the morphology of the larva and the male hypopygium, are added to those distinguishing the short-winged *Anopheles maculipennis* var. *atroparvus*, van Thiel [*R.A.E.*, B, xv, 181]. Breeding experiments show that they are much less influenced by environmental factors than differences in size or maxillary teeth, which affords additional evidence that the differences in the two forms of *A. maculipennis*, Mg., in Holland are racial and not due to the breeding-places. This also applies to differences in the morphology of the eggs. The typical (long-winged) *A. maculipennis* did not mate in the laboratory, but *atroparvus* did so, as it can do in cowsheds, without swarming of the males. Successive generations also bred true to the biological character of the limited hypertrophy of the fat-body in autumn [*cf.* xvii, 221; xviii, 53]. The hypertrophy of the fat-body in the long-winged race at the end of the summer may be associated in nature with the ingestion of vegetable fluids, as it is most readily produced in the laboratory by feeding on sugar solution. The habit of this race of not sucking blood in autumn and winter cannot be completely overcome by keeping it in a heated room, for even then digestion of blood is extremely slow, so that it is very difficult to infect with malaria.

BRIGHENTI (D.). **Ricerche sull' *Anopheles sacharovi* Favr. (Nota II.)** [Researches on *A. sacharovi*. Note II.]—*Riv. Malariol.*, ix, no. 2, pp. 130–134, 5 refs. Rome, 1930. (With Summaries in Italian, p. 202, French, p. 204, English, p. 206, German, p. 208.)

Continuing his investigations on *Anopheles sacharovi*, Favr [*R.A.E.*, B, xvii, 219], the author concludes that this mosquito is a mutant form of *A. maculipennis*, Mg., that has only recently been produced. It possibly appeared in Russia, where it was found early in the present century, and has invaded most of Mediterranean Europe and Asia. In some regions, such as Palestine, its spread has been more rapid than in others. In Italy it occurs in the north and, as has been confirmed by further experiments, it has a seasonal dimorphism [*loc. cit.*]. Reference is made to mutations observed in other mosquitos.

VAUCEL [M.]. **La lutte contre le paludisme en Yougo-Slavie et en Italie.**—*Ann. Méd. Pharm. col.*, xxviii, no. 1, pp. 5–34. Paris, 1930.

The information obtained by the author during a tour to study the measures taken to control malaria in Jugoslavia and Italy is briefly discussed. He concludes that the use of Paris green against Anopheline larvae is most economical in well-populated centres, whereas quinine becomes more expensive the larger the number of persons to be treated. Any measures that reduce the number of Anophelines are of importance, and such measures are tending to replace the use of quinine.

[PAZHITNOVA (Z. A.).] **Пажитнова (З. А.). Material for the Investigation of the Microfauna of Rice-fields and the Biology of Anopheline Larvae in Rice-fields.** [*In Russian.*]—*Acta Univ. Asiae mediae*, Ser. viii–a. Zool., fasc. 10, pp. 1–40, 4 graphs., 25 refs. Tashkent, 1929. (With a Summary in German, pp. 37–40.)

The Anophelines found breeding in rice-fields in the Tashkent district were *Anopheles maculipennis*, Mg., *A. hyrcanus* var. *pseudopictus*, Grassi, and *A. pulcherrimus*, Theo., the larvae being most numerous in the first half of September. Observations showed the length of the larval stage in days at different average temperatures to be as follows: *A. maculipennis*, 11·5 at 28° C. [82·4° F.] and 12 at 27° C. [80·6° F.] and 23° C. [73·4° F.]; *A. hyrcanus* var. *pseudopictus*, 16 at 20° C. [68° F.]; and *A. pulcherrimus*, 10 at 23·6° C. [74·5° F.].

BASU (B. C.). **Studies in the Anopheline Fauna and Malaria of Bhagalpur (Bihar and Orissa).**—*Ind. Med. Gaz.*, lxv, no. 7, pp. 375–379, 6 figs., 9 refs. Calcutta, July 1930.

These studies, conducted in October 1929, give the first detailed record of the Anopheline fauna and malaria in the town of Bhagalpur. The average temperature rises as high as 97° F. in April and falls as low as 50° F. in January. The average relative humidity may be as high as 87 per cent. in July and August, and as low as 52 per cent. in March. The average annual rainfall is 43·63 ins., the maximum being reached in July. The town is naturally and rapidly drained into the river Ganges, though stagnation of water in the drains along the sides of the roads in the middle of the town is not uncommon. The Anophelines found were: *A. barbirostris*, Wulp, *A. fuliginosus*, Giles, and *A. hyrcanus*, Pall., breeding in the settling tanks from which the town's water supply is obtained; *A. culicifacies*, Giles, in certain borrow pits; *A. subpictus*, Grassi, in the settling tanks, in stagnant water in the roadside drains and in collections of stagnant water at the foot of street hydrants; and *A. stephensi*, List., in reservoirs for storing water in houses, in the settling tanks and filter beds, and in small collections of rain-water in drains lying parallel to the latter. The settling tanks and filter beds are frequently dried for cleaning purposes, and the larvae breeding in them have little chance of completing their development.

A. stephensi was by far the most numerous species and is probably responsible for the transmission of malaria in the town; though such other vectors as *A. culicifacies* and *A. fuliginosus* are present, their

numbers and suitable breeding-places are so restricted that they appear to be negligible. The disease is more or less prevalent throughout the year, reaching its maximum in August and dropping to a minimum in December.

PHILLIPPS (W. J.). **Use of Fishes for Control of Mosquitoes.**—*N.Z. J. Sci. Tech.*, xii, no. 1, pp. 19–20. Wellington, N.Z., June 1930.

The mosquito menace is not regarded as serious in New Zealand, where Anophelines have not yet become established, though in view of their possible introduction and also because of the discomfort arising from the attacks of indigenous Culicines, the mosquito-eating fish, *Gambusia*, is being imported. The success of this fish in other countries is briefly reviewed. There are five species of fish indigenous to New Zealand that are probable enemies of mosquitos, though the only one in which mosquito larvae have actually been found is the smelt (*Retropinna retropinna*).

BAKER (J. R.). **Man and Animals in the New Hebrides.**—8vo, xiv+ 200 pp., 42 figs. London, G. Routledge & Sons, Ltd., 1929. Price 12*s.* 6*d.*

In some parts of Espiritu Santo, *Anopheles punctulatus*, Dön., a very serious pest in the New Hebrides, is extremely abundant, but in other parts it is rarely seen. It bites only between sunset and sunrise. No other species of *Anopheles* had hitherto been recorded from the whole of Melanesia south of New Britain, but larvae of a distinct, undetermined species were found in a locality in which *A. punctulatus* was rare.

Aëdes variegatus var. *hebrideus*, Edw., is not abundant in the sun or the forest, but is very troublesome in the shade in coconut plantations, particularly during January. It appears to be most active at about 5 p.m., and seldom bites after 7 p.m. It breeds chiefly in discarded shells of coconut, and could be kept in check by burning these.

WALKER (C. R.). *Anopheles quadrimaculatus* **Say in Colorado.**—*Canad. Ent.*, lxii, no. 7, pp. 150–151, 6 refs. Orillia, Ont., July 1930.

Among collections of mosquitos from Colorado, an Anopheline has only once been recorded, and its identification was uncertain. The author now reports the finding of both adults and larvae of *Anopheles quadrimaculatus*, Say, in July 1928 and August 1929.

BOYD (M. F.). **The Cage Rearing of** *Anopheles quadrimaculatus*.—*Amer. J. Trop. Med.*, x, no. 3, pp. 165–175, 5 figs. Baltimore, Md., May 1930.

As the result of experiments carried out in North Carolina, extending over several years, the author has discovered methods by which *Anopheles quadrimaculatus*, Say, can be reared in an outdoor insectary for more than one generation. An insectary 8 feet square and 7 feet high was not suitable, as mating did not take place in it, and consequently only infertile eggs were laid, but mating took place in a structure 8 feet square by 12 feet high. The construction of the larger insectary and the methods of rearing the mosquitos in it are described.

A cool and moist resting place for the adults during the day was provided by a dome-shaped shelter of porous bricks with its base in a vat, let into the floor, containing sand, gravel and water. A second vat, filled with water and containing aquatic plants, served as a place for oviposition. Eggs and young larvae were removed daily to enamelled pans on a shelf in the insectary, where the larvae were reared on yeast.

From first instar larvae placed in the insectary between 28th July and 10th August, adults were obtained between 11th and 28th August. The females of this generation oviposited between 7th and 24th September, and adults of another generation emerged between 21st September and 19th October, but these were fewer than those of the previous generation, had less appetite for blood and did not lay any eggs. The proportion of larvae that produced adults was, however, larger in the later than in the earlier generation, and the maximum length of life was the same in both, *viz.*, two months for males and three months for females. A few individuals passed through all stages of development much more quickly than the rest. Males slightly exceeded females in numbers, and emerged 1–2 days earlier. In most cases, males lived as long as females, but a few females in each brood survived unusually long. Certain nights seemed particularly favourable for the swarming of the males, which took place just under the roof of the insectary; the males did not leave the places where they had sheltered during the day until the sky was dark.

EARLE (W. C.). **Malaria in Porto Rico.** —*Amer. J. Trop. Med.*, x, no. 3, pp. 207–230, 8 refs. Baltimore, Md., May 1930.

In Porto Rico, malaria is most severe in the rural areas of the coastal plain, where it is not unusual to find parasites in the blood of 25–35 per cent. of the population; it is not a serious problem in the mountains of the interior, nor as a rule in the foothills. Malaria transmission probably occurs throughout the year in the coastal plain, but the period of epidemics usually extends from September to December. *Plasmodium falciparum* and *P. vivax* are responsible for almost equal numbers of cases, but *P. malariae* is only occasionally found.

Anopheles albimanus, Wied., and *A. grabhami*, Theo., occur throughout the greater part of the Island, but they are much more abundant on the coast than inland, and at 600 feet above sea level their breeding period is very short. On the coast, the minimum winter temperature averages 66° F., and rarely falls below 60°, whereas in the mountains it averages 61° and may fall to 43°. The rapidity with which the rains run off and their scouring effect undoubtedly limit the breeding of these Anophelines in the mountains. *A. vestitipennis*, D. & K., is confined to the coast. *A. albimanus* is usually most numerous from August to December, which is normally the period of greatest rainfall and of transition from the hottest to the coolest months. *A. grabhami* is usually commonest in the cooler months from January to March, and it is only during this period that its numbers exceed those of *A. albimanus*. *A. vestitipennis* has been found in appreciable numbers only on a few occasions and in two districts, generally from October to January. *A. albimanus* is present in every region of Porto Rico in which malaria is endemic, its season of maximum abundance corresponds with the season of highest malarial incidence, and it has been the predominant species, if not the only one, in all epidemics of

malaria investigated. Stomach infections developed in four out of seven individuals of *A. albimanus* fed on a malaria patient, and stomach infections were found in 0·89 per cent. of 790 taken in nature.

The breeding-places of the three species of *Anopheles* in Porto Rico are very similar, the most important being natural or artificial bodies of water of greater or less extent outside the towns. *A. albimanus* breeds in both temporary and permanent water deposits, and under favourable conditions it can complete its life-cycle in 10 days. Although it breeds mainly in more or less stagnant water, it can also breed in swiftly flowing streams, where there is a little vegetation, and during the dry months it breeds freely in streams in the foothills. In the lowlands near the sea there are extensive breeding grounds, but where large bodies of water are formed with little vegetation, wind and wave action prevent breeding, whereas on the other hand growth of mangrove, reeds or sugar-cane may become so dense as to limit the breeding of *A. albimanus*, although permitting the breeding of *A. grabhami*. The salt content of the water in many places that are below high water mark is continuously high, but it is rarely above 2·5 per cent., which allows *A. albimanus* to breed freely, although *A. grabhami* does not breed to any extent in water containing 1 per cent. salt or more. In the cultivated lands well above tide level, drainage and irrigation ditches are important as breeding-places, but if irrigation is properly supervised and proper drainage channels are provided for the waste irrigation water, breeding in these can be controlled. The areas at or below the level of high tide that are subject to floods should be reclaimed, using pumps to drain them ; in the extensive seepage areas in the south of the Island, subsoil drainage with tiles offers the best solution of the problem.

Small fish, especially *Poecilia vivipara* and *Dormitator maculatus*, are very abundant in some districts, but although they feed on Anopheline larvae in captivity, they do not seem to control them in nature.

For preventing breeding in water that cannot be drained, dusting with Paris green and powdered limestone at weekly intervals has given good results. The author considers that measures against mosquito larvae cannot always be relied upon to control malaria and that efficient treatment of infected persons is an essential part of a campaign against it.

Wells (C. W.). **The Identification of the Anopheline Mosquitoes of Porto Rico.**—*Amer. J. Trop. Med.*, x, no. 4, pp. 243–248, 5 figs., 2 refs. Baltimore, Md., July 1930.

Characters are given by which the adults and larvae of the three Anophelines occurring in Porto Rico may be readily identified. Of these species, *Anopheles albimanus*, Wied., is a known vector of malaria, but the relation of *A. grabhami*, Theo., and *A. vestitipennis*, D. & K., to the disease has not yet been determined.

Cook (S. S.). **Malaria Control in Haiti.**—*Southern Med. J.*, xxiii, no. 5, pp. 454–459, 5 refs. Birmingham, Ala., May 1930.

Work on the control of malaria and its vector, *Anopheles albimanus*, Wied., in Haiti, of which a brief account is given, consists chiefly in drainage and filling, and the use of larvicides and quinine [*cf. R.A.E.*,

B, xvi, 94, 95]. Until recent years oil was the principal larvicide used, but as new areas are brought under control, the cost of the oil used increases, and attempts have been made to substitute Paris green. Successful results were obtained in two areas dusted by aeroplane with a mixture of 33 per cent. Paris green and slaked lime, used at the rate of 1 lb. Paris green to the acre. Paris green with wet sand as used by Griffitts [xvi, 65] proved effective in destroying both Anophelines and Culicines, and even when the amount of the mixture used to the acre was reduced to $\frac{1}{2}$ or even $\frac{1}{3}$ a mortality of 80–90 per cent. was sometimes obtained. The dust was not satisfactory, however, at a lower concentration than 1 : 100.

Soesilo (R.). **Aanvulling op de artikel van de Rook en Soesilo over** *Anopheles papuae*. [Supplement to the Article on *A. papuae* by de Rook and Soesilo.]—*Geneesk. Tijdschr. Ned.-Ind.*, lxx, no. 7, pp. 695–696, 1 fig. Weltevreden, 1930.

In each of two small collections of *Anopheles papuae*, Swellgr. [*cf. R.A.E.*, B, xviii, 207] was found a female with long palpi (slightly shorter than the proboscis), but otherwise normal. In the breeding-place from which one of them originated were found three larvae that differed from those of *A. papuae* only by having a plume at the tip of the central clypeal hairs.

Hinman (E. H.). **A Study of the Food of Mosquito Larvae (Culicidae).** —*Amer. J. Hyg.*, xii, no. 1, pp. 238–270, 5 pp. refs. Baltimore, Md., July 1930.

Examination of the digestive tract of over 600 mosquito larvae of many different species and habitats showed that they ingest any material that is small enough to be taken in by the mouth brushes, a large proportion of this material apparently passing through the alimentary canal unchanged. Living protozoa and rotifers were observed swimming about far back in the intestine. The theory that food is a limiting factor in the distribution of mosquito larvae has been discussed by many investigators ; the author is inclined to believe that distribution is not controlled by nutritional factors, and this view seems to be supported by his dissections. The consensus of opinion of other workers seems to support the theory of preferential feeding ; the author's work, however, does not confirm this, and he suggests that their conclusions may be due to unequal distribution of the organisms forming the plankton and the manner in which they are clustered or grouped. Attempts to recover pure cultures of bacteria from the intestinal tract of the larvae gave inconclusive results. Larvae failed to mature in sterile, synthetic media. Experiments in rearing them on pure cultures of *Chlorella* sp. were unsuccessful, possibly owing to injurious action of the algal media. Autoclaving water taken from normal breeding-places so changes its nature that larvae could not be reared in it, but the addition of certain types of bacteria to such autoclaved water made it suitable for complete larval development. The work of previous investigators has shown that the larvae are able to filter a relatively large amount of water and that the material passes through the intestines in a very short time. The author believes that a considerable proportion of the actual food is probably absorbed from materials in

solution and colloids in suspension ; the latter may be largely products of decay, excretory wastes and organic materials of widely varying origin. This theory has been amply verified by the rearing of the larvae of *Aëdes argenteus*, Poir. (*aegypti*, auct.) to maturity under sterile conditions *cf. R.A.E.*, B, xviii, 109]. Eggs of this species, sterilised on the exterior, have been introduced into water passed through a Berkefeld filter, and normal adults have emerged in 8–9 days, which is the usual time for transformation under the most favourable conditions.

St. John (J. H.), Simmons (J. S.) & Reynolds (F. H. K.). **The Survival of various Microörganisms within the Gastro-intestinal Tract of** *Aëdes aegypti*.—*Amer. J. Trop. Med.*, x, no. 4, pp. 237–241, 2 refs. Baltimore, Md., July 1930.

The following is the authors' summary : *In vitro* experiments made to test for possible germicidal action of the gastro-intestinal secretions of *Aëdes argenteus*, Poir. (*aegypti*, auct.) on *Bacillus typhosus* and *B. prodigiosus* were negative. *In vivo* experiments to determine the length of life of *B. prodigiosus*, *B. leprae*, *Staphylococcus aureus* and *Cytoryctes variolae* within the gastro-intestinal canal of *A. argenteus* show that these organisms survived for at least 24 hours, but that they could not be demonstrated after an interval of seven or more days. It seems probable that *A. argenteus* does not regurgitate its midgut contents while feeding. Since no germicidal action could be demonstrated in the gastro-intestinal fluids of *A. argenteus in vitro*, it seems probable that the organisms ingested by the mosquito were not killed as a result of the presence of an active bactericidal principle, but either failed to find a suitable environment for continued development within the insect and were slowly digested, or were eliminated with the faeces. The disappearance of the organisms tested from the gastro-intestinal tract of *A. argenteus* within a short interval of time suggests that the only way in which these organisms could be transferred to the skin of man would be by interrupted feedings repeated at frequent intervals.

Séguy (E.). **Contribution à l'étude des Diptères du Maroc.**—*Mém. Soc. Sci. nat. Maroc*, no. xxiv, 206 pp., 115 figs., 4 pp. refs. Rabat, 30th August 1930.

This review of the Dipterous fauna of Morocco comprises an annotated list of the species, with descriptions of new ones.

The mosquitos recorded include *Aëdes argenteus*, Poir. (*Stegomyia fasciata*, F.) and the following species of *Anopheles* : *A. algeriensis*, Theo., *A. bifurcatus*, L., *A. multicolor*, Camb. (*chaudoyei*, Theo.), *A. gambiae*, Giles (*costalis*, Theo.), *A. hispaniola*, Theo., *A. maculipennis*, Mg., *A. mauritianus*, Grp., and *A. sergenti*, Theo. Other blood-sucking flies include *Phlebotomus minutus*, Rond., *P. papatasii*, Scop., *P. perniciosus*, Newst., and *P. sergenti*, Parr. ; 10 species of *Simulium*, of which 3 are new ; and 41 Tabanids, of which 3 are new. Oestrids recorded as parasites of domestic animals are *Rhinoestrus purpureus*, Br., on horses ; *Oestrus ovis*, L., on sheep and goats ; *Cephalopsis titillator*, Clark, on camels ; *Gastrophilus* (*Gasterophilus*) *flavipes*, Ol., on donkeys ; *G. intestinalis*, DeG., on horses,

dogs, donkeys and mules ; *G. pecorum*, F., on equines ; and *G. nasalis*, L. (*veterinus*, Clark), on horses and mules. The Hippoboscids include *Pseudolynchia maura*, Big., on pigeons ; *Melophagus ovinus*, L., on sheep ; *Hippobosca maculata*, Leach, on cattle ; *H. equina*, L., on dogs, horses and cattle ; *H. camelina*, Leach, and *H. dromedarina*, Speis., on camels ; and *H. capensis*, Olf., on dogs. The last three species all occur occasionally on horses and cattle.

PARROT (L.). **Sur une collection de Phlébotomes du Congo Belge.**—*Rev. Zool. Bot. afr.*, xix, fasc. 2, pp. 181–191, 15 figs. Brussels, 30th July 1930.

This collection of sandflies from the Belgian Congo, in addition to five of the species already noticed [*R.A.E.*, B, xviii, 4], includes *Phlebotomus squamipleuris*, Newst., and *P. minutus* var. *antennatus*, Newst., not previously recorded from the country, of which both sexes are described, *P. brodeni*, sp. n., described from the female, and *P. rodhaini*, sp. n., from the male.

HENRARD (C.). **Quelques protozoaires parasites des larves de *Simulium* congolais.**—*Rev. Zool. Bot. afr.*, xix, fasc. 2, pp. 226–231, 15 refs. Brussels, 1930.

Simuliid larvae from the Belgian Congo were found to be infested with protozoan parasites, *viz.*, *Thelohania multispora*, *T. bracteata*, *T. fibrata* and *Coelomycidium simulii*, all of which have also been recorded from the larvae in both Europe and America. From the intensity of infection and the size of the tumours formed, it would appear that there must be at least a mechanical injurious effect on the larvae, and it seems evident that these protozoa destroy numbers of Simuliids, although not all the larvae parasitised have their development arrested.

ADLER (S.) & THEODOR (O.). **Infection of *Phlebotomus perniciosus*, Newstead with *Leishmania infantum*.**—*Nature*, cxxvi, no. 3177, p. 437. London, 20th September 1930.

Females of *Phlebotomus papatasii*, Scop., and *P. perniciosus*, Newst., were fed at Catania on a Chinese hamster [*Cricetulus*] during the earliest stages of its infection with local strains of *Leishmania infantum*. Out of 5 wild and 13 laboratory bred females of *P. perniciosus* 83 per cent. became infected, as compared with only one out of 51 wild and 72 laboratory bred females of *P. papatasii*. In both sandflies the flagellates tended to adopt an anterior position ; in *P. perniciosus* at 29–30° C. [84·2–86° F.] flagellates were found in the pharynx 3½ days after the infecting feed. No natural infection was found in 319 wild females of *P. perniciosus* or 2,694 of *P. papatasii*.

Wild individuals of *P. papatasii* were also infected by feeding through membranes on infected human bone marrow. It was found that there was occasionally a slight infection rate if smears of the marrow showed an average of at least one Leishman-Donovan body to 20 fields (Oc. 4 Obj. $\frac{1}{12}$) and no infection with one to 40 fields. By culture methods it was possible to demonstrate the presence of L. D. bodies

in the circulating blood in almost 100 per cent. of cases of infantile kala-azar (in some cases with only 5 cu. mm. of blood), but a concentration of one L.D. body to 40 fields in the blood has never yet been observed. *P. papatasii* can therefore be excluded as an important vector of *L. infantum*. The highest infection rate in wild individuals fed on heavily infected bone marrow is 26 per cent.

P. perniciosus takes on an average a much smaller feed than *P. papatasii*, and the high infection rate produced in the former by relatively few L. D. bodies shows that *L. infantum* is particularly well adapted to this sandfly, which should be considered an effective vector of infantile kala-azar in Italy.

Adler (S.) & Theodor (O.). **The Behaviour of Insect Flagellates and Leishmanias in** *Phlebotomus papatasii*.—*Ann. Trop. Med. Parasit.*, xxiv, no. 2, pp. 193–196, 3 refs. Liverpool, 8th July 1930.

The authors have previously described the behaviour of various strains of *Leishmania* in *Phlebotomus papatasii*, Scop., infected by feeding on emulsions of flagellates in inactivated rabbit blood [*R.A.E.*, B, xv, 54, 221 ; xvii, 97]. *L. tropica* from cultures has been found to behave similarly to *L. tropica* ingested from oriental sores. The flagellates multiplied, ascended the cardia and pharynx and in a few cases entered the proboscis. Of four strains of *L. donovani* of Mediterranean origin, one remained in the stomach, the three others and two strains of *L. tarentolae* behaved similarly to *L. tropica*. Two other strains of *L. donovani* from Naples produced a low infection rate in *P. papatasii*, but if the infection was established, the parasites ascended to the top of the cardia and attached themselves to the rhabdorium. Two strains of *L. donovani* from India attached themselves to the rhabdorium in the cardia if ingested in sufficient quantities, but the infection tended to die out. A strain of *L. donovani* from China, which was abnormal in that its maximum size was only 11·2μ and it was usually devoid of a flagellum or showed only a very short one, remained in the stomach of *P. papatasii* even if ingested in doses of 8,000 parasites per feed. One strain of *L. brasiliensis*, which was abnormally small, remained in the stomach, and another strain ascended and attached itself to the rhabdorium near the oesophageal valve if ingested in sufficient quantities. *L. ceramodactyli* adopted a typical posterior position, but the flagellates ascended the cardia, attached themselves to the rhabdorium and even entered the pharynx if the infection was very heavy.

The behaviour of *L. tropica* and *L. ceramodactyli* in *P. papatasii* was interpreted as showing a specific host-parasite relationship between the insect and the protozoon. The behaviour of the other normal strains is interpreted as proving that *P. papatasii* is not the usual vector, but they still showed some specific characters in that they attached themselves to the rhabdorium of the cardia and entered the pharynx and buccal cavity. The specificity is quite definite in the case of *L. tropica*, for the behaviour of the flagellates is independent of the intensity of the infection produced in the sandfly. In other cases the specificity was of a lower order, for it depended on quantitative factors such as the intensity of the infection produced. A strain of *L. agamae* was very irregular in behaviour ; the flagellates generally confined themselves to the stomach, occasionally descending into the hindgut, and

very rarely ascended the cardia and attached themselves to the rhabdorium. All the strains that tend to adopt an anterior position when established in the sandfly are closely related serologically. All the above contain group agglutinins except *L. ceramodactyli* and *L. agamae*, which can be readily distinguished serologically from the others.

Experiments were also carried out with four species of *Herpetomonas* from various insects, one of which was also obtained from a plant, and their behaviour in *P. papatasii* is described. In no case was there any tendency to ascend the cardia.

ADLER (S.) & THEODOR (O.). **The Inoculation of Canine Cutaneous Leishmaniasis into Man and the Behaviour of various Strains of Leishmania in Mice.**—*Ann. Trop. Med. Parasit.*, xxiv, no. 2, pp. 197–210, 2 pls., 6 refs. Liverpool, 8th July 1930.

In experiments, which are described, infection was produced in man with cutaneous leishmaniasis from a culture from a naturally occurring oriental sore in a dog in Baghdad. It is therefore considered to be proved that there is a cutaneous leishmaniasis common to man and dogs and that *Leishmania tropica* is a naturally occurring parasite of the dog. Cultures of a Palestine strain of *L. tropica* and a Tunis strain of canine visceral *Leishmania* were found to produce cutaneous lesions in mice after inoculation into the tail, and visceral and cutaneous lesions after intraperitoneal inoculation. The canine strain from Baghdad behaved similarly to *L. tropica* in *Phlebotomus papatasii*, Scop.; the flagellates ascended the cardia and attached themselves to the rhabdorium, and in many cases the cardia was choked with flagellates. Sections of whole sandflies show that large numbers of parasites may enter the pharynx. The results recorded do not show any distinction between this strain and *L. tropica*.

SCHWETZ (J.). **Some Ecological Notes on *Glossina newsteadi* Austen.** —*Ann. Trop. Med. Parasit.*, xxiv, no. 2, pp. 211–216, 1 map, 1 ref. Liverpool, 8th July 1930.

The following is taken from the author's summary of observations in the north-central Belgian Congo: It would appear that from the ecological point of view, *Glossina newsteadi*, Aust., occupies an intermediary place between the *palpalis* and *fusca* groups, as although it may sometimes occur with *G. palpalis*, R.-D., on the banks of rivers, it is also found with *G. fusca*, Wlk., and *G. tabaniformis*, Westw., at a distance from water. Moreover, although it is sometimes taken in broad daylight, it is active chiefly in the morning and evening, which also makes it akin to the *fusca* group. Although from a morphological point of view, *G. newsteadi* belongs to the *palpalis* group, it is distinguished from most species in this group by its greater size and lighter colour, which allies it to the *fusca* group. It is therefore evident that the biological or at any rate the ecological differences correspond to the morphological ones.

In a footnote, Major E. E. Austen remarks that museum examples of *G. newsteadi* are as dark as those of *G. caliginea*, Aust., and darker than those of *G. pallicera*, Big., and that there is no constant difference in size.

GORDON (R. M.) & DAVEY (T. H.). **An Account of Trypanosomiasis at the Cape Lighthouse Peninsula, Sierra Leone.**—*Ann. Trop. Med. Parasit.*, xxiv, no. 2, pp. 289–318, 3 pls., 1 map, 9 refs. Liverpool, 8th July 1930.

The authors briefly review the work of other investigators with regard to trypanosomiasis and the occurrence of *Glossina palpalis*, R.-D., on Cape Lighthouse Peninsula, Sierra Leone, and report on their own investigations in 1928 [*cf. R.A.E.*, B, xviii, 176] and 1929. It is evident that trypanosomiasis of man and animals has been endemic there at least since 1915, when investigations were begun. Only a few cases of infection by *Trypanosoma gambiense* have actually been observed among the population, but the authors are convinced that chronic benign cases are more numerous than these findings suggest. In many cases partial immunity seemed to have been acquired and the number of trypanosomes was too scanty for detection except by repeated examinations. Sheep and other domestic animals become infected with *T. vivax* early in life, and later on, although still capable of infecting a large proportion of the individuals of *G. palpalis* that feed upon them, do not possess sufficient trypanosomes in the peripheral blood for these to be demonstrable in ordinary preparations. Examination of flies indicated a definite though fluctuating increase in the percentage of infection during recent years. The infections are mainly due to *T. vivax* and *T. congolense*, the former being much more common. Transmission experiments show that sheep are in all probability the main reservoir from which *G. palpalis* obtains *T. vivax*; similarly, dogs (and possibly goats) are responsible for the *T. congolense* type of infection. Wild game is negligible as a source of trypanosome infection.

The clearing accomplished on the Peninsula has resulted in a marked decrease of the fly on the cleared area and a similar though less marked reduction on the uncleared, the average captures per boy per hour for 1928 and 1929 being 1·1 flies on the cleared and 2·3 on the uncleared area. *G. palpalis* rarely larviposits on the cleared area, and only in reduced numbers on the uncleared or partly cleared areas. As in Nigeria, breeding of this fly is almost exclusively confined to the dry season, although the sites selected are different.

BEQUAERT (J.). **Tsetse Flies—Past and Present (Diptera : Muscoidea).**—*Ent. News*, xli, nos. 5–7, pp. 158–164, 202–203, 227–233. Philadelphia, Pa., May–July 1930.

This general review of present knowledge on the flies of the genus *Glossina* is almost entirely based on a recent work by Hegh [*R.A.E.*, B, xvii, 121], with brief additional notes on their relation to trypanosomiasis of man and animals.

DUKE (H. L.). **Factors influencing Trypanosome Infection Rate in Tsetse Flies.**—*Trans. R. Soc. Trop. Med. Hyg.*, xxiv, no. 1, pp. 125–127. London, 30th June 1930.

The author gives reasons for doubting Lloyd's conclusion that the factors that influence the rate of infection in *Glossina* by trypanosomes are so many that it is impossible to estimate with any degree of accuracy the transmissibility of any particular strain [*R.A.E.*, B, xviii, 172], and

considers that useful comparison between the transmissibility of different strains can be obtained by the employment of a regular experimental procedure and a reasonable number (400–500) of flies per strain. Although he has modified his view that if the appropriate forms of the trypanosomes are taken up by the fly, they will always develop [xvii, 41], he maintains that the fly is an invariable factor.

HINDLE (E.). **Attempts to infect Hamsters with various Flagellates.**—*Trans. R. Soc. Trop. Med. Hyg.*, xxiv, no. 1, pp. 97–104, 16 refs. London, 30th June 1930.

In order to test the view that ordinary insect flagellates may develop in a vertebrate and produce forms of leishmaniasis, a limited number of experiments were undertaken in which hamsters (*Cricetulus*), which are extremely susceptible to infection with *Leishmania*, were inoculated with various strains of *Herpetomonas* (*Leptomonas*). The results support the generally accepted opinion that ordinary insect flagellates do not survive in vertebrates, unless they represent a stage in the development of a vertebrate parasite. The negative results obtained with *Leishmania ceramodactyli* from a gecko and *L.* [*agamae*] from a Palestine lizard, *Agama stellio*, do not support the view that lizards, especially geckos, may serve as reservoirs of human leishmaniasis.

HAMLYN-HARRIS (R.). **Halticinae (Col.) as possible Factors in natural Control of Mosquitos in Queensland.**—*Bull. Ent. Res.*, xxi, pt. 2, p. 159. London, July 1930.

Haltica ignea, Blackb., was found to be responsible for large black patches of dead vegetation among *Jussiaea repens* (yellow primrose) in the polluted water of a canal where, during a period of drought, *Culex fatigans*, Wied., was breeding in large numbers in spite of repeated oilings. Other aquatic vegetation present included *Hydrilla verticillata* (water thyme) and *Eichhornia speciosa* (water hyacinth). Closer observation showed that the water in the neighbourhood of the blackened vegetation was also discoloured, and contained only dead mosquito larvae, whereas the larvae outside the blackened area were alive and normal. That the poisonous properties of the beetle were not confined to its larvae was shown by the effects of the excreta of the adults upon the mosquito larvae present before the Halticine larvae came into existence.

DE MEILLON (B.). **On the Ethiopian Simuliidae.**—*Bull. Ent. Res.*, xxi, pt. 2, pp. 185–200, 6 figs., 20 refs. London, July 1930.

In order to facilitate the determination in the field of the various species of Simuliids belonging to the Ethiopian Region, a key is given to the females, and figures of the male genitalia and pupal filaments are reproduced. These filaments may also be dissected from the mature larvae for identification. The larvae and pupae of all species known so far are found only in running water and die in ordinary breeding receptacles in the laboratory. The following new species are described : *Simulium bovis* from cattle in Zululand and Nyasaland ; *S. blacklocki* (described by F. W. Edwards) from Sierra Leone ; and *S. woodi* and *S. nyasalandicum* from Nyasaland. *S. nigritarsis*, Coq., of which the female is re-described and the male described for the first

time, is recorded from Nyasaland and South Africa. *S. neavei*, Roub., is suspected of being the carrier of a disease among natives in Kenya [*R.A.E.*, B, x, 16] and also occurs in Uganda. *S. griseicolle*, Becker, which is recorded from the Anglo-Egyptian Sudan, Northern Nigeria and Sierra Leone, bites from sunrise to sunset and attacks any part of man or beast unprotected by clothes or hair. It occurs from January to April, but is not aggressive on cold days and is destroyed in large numbers and finally controlled by hot weather. It is not found more than half a mile from rivers. *S. wellmanni*, Roub., which is recorded from Angola, South Africa and the Belgian Congo, bites viciously, leaving large weals that irritate for several days. *S. damnosum*, Theo., which occurs over almost the whole Ethiopian Region, is particularly troublesome in Uganda [xiii, 167] and has been shown to be the vector of *Onchocerca volvulus* in Sierra Leone [xiv, 62, 167].

NASH (T. A. M.). **A Contribution to our Knowledge of the Bionomics of** *Glossina morsitans*.—*Bull. Ent. Res.*, xxi, pt. 2, pp. 201–256, 1 fldg. map, 8 figs., 5 refs. London, July 1930.

This very detailed study of the habits of *Glossina morsitans*, Westw., in the neighbourhood of the Kikori Entomological Station, Tanganyika Territory, should be consulted in the original.

The following is taken from the author's general conclusions and summary : Laboratory and field experiments indicate that *G. morsitans* hunts its food entirely by sight ; the olfactory organs of the antennae are only operative over a very limited field. Possibly they stimulate the fly to probe, and are capable of selecting the best places for the insertion of the proboscis. Without its antennae it appears to have difficulty in correlating its desire to follow and alight upon a moving object with its desire for food. Extreme hunger, however, may constitute a sufficient stimulus to induce probing when the olfactory organs are rendered functionless.

The true habitats of the fly coincide with the major breeding sites, which are characterised by perennial, if variable, shade and poor visibility. In the eastern Kondoa Fly Belt, the *Berlinia-Brachystegia* woods and small thickets constitute such habitats. The fly multiplies during the favourable season that follows the rains, and when the sky is cloudy and even the savannah shrubs are green and umbrageous, it is scattered throughout the bush. It is scarce during the unfavourable dry season, concentrating in its true habitat when the open country becomes leafless. The *Berlinia-Brachystegia* woods are considered to be the centres from which it advances or to which it retreats, according to the season. The open " mbuga " country (grassy steppe) constitutes the feeding ground for both sexes, but at no season does it form a habitat. Hungry flies leave the shade of the woods to search for game in the open " mbuga," where the good visibility is suited to insects that appear to hunt by sight. A road may constitute a feeding ground in the absence of open country. These areas may be recognised by the relatively high female percentage and the starved condition of the fly. Puparia collected from the Kikori bush give the natural percentage of females as 53, and the percentage of parasitism by *Thyridanthrax abruptus*, Lw., as 9·7. Only large game movements, which invariably cause a marked increase in the natural percentage of females, have any noticeable effect upon the fly community. Females are believed to be

as abundant as males within the true habitat, but are inactive between meals and usually only fly when in need of food. A concentration of flies formed around game concentrated in the vicinity of certain pools sometimes remains after the pools have dried up and the game has left, being composed of ever changing individuals recruited from the hungry, hunting flies of the " mbuga."

KEARNS (H. G. H.). **Early Spring Swarming of** *Chloropisca circumdata*, **Meig., with Notes on the Control of the Flies in Autumn.**—*Ent. Mo. Mag.*, lxvi, nos. 794 & 795, pp. 166–169. London, July & August 1930.

Swarming of *Chloropisca notata*, Mg. (*circumdata*, Mg.) in the early part of March 1930 is recorded near Bristol, where the flies were found to be present in a compact mass resting on the sunny side of a telegraph pole about 5 ft. from the ground. They disappeared by 5 p.m. of the same day and did not return. Instances of annoyance caused by autumnal swarming of the flies in houses is also given. In infested houses under observation, however, most of the flies have either been killed by various insecticides in the autumn, or succumbed to unsuitable environment by the end of December, so that the spring dispersal has never been noticed. According to Austen, this Chloropid swarms in rooms from early September to May and breeds in *Lolium perenne* and other wild grasses. The possible reasons for these swarming habits are briefly discussed. The flies may be controlled by spraying daily at the time of maximum swarming with pyrethrum extract or orthodichlorobenzene used as a fine mist. The odour of the latter spray is, however, considered objectionable by many people and persists for several days, being readily absorbed by certain foods, especially milk products. Care should be taken to spray inaccessible corners likely to afford shelter for the flies from which they are liable to emerge when fires are lighted. Windows, etc., should be screened with butter muslin as soon as the first flies are observed.

TURNER (A. W.) & MURNANE (D.). **On the Presence of the non-pathogenic** *Trypanosoma melophagium* **in the Blood of Victorian Sheep, and its Transmission by** *Melophagus ovinus*.—*Aust. J. Exptl. Biol. Med. Sci.*, vii, pt. 1–2, pp. 5–8, 1 pl., 16 refs. Adelaide, 16th June 1930.

Trypanosoma melophagium has been found in the blood of sheep in Victoria, and the results of experiments have confirmed Hoare's finding that its transmission by *Melophagus ovinus*, L., is by ingestion [*R.A.E.*, B, x, 222 ; xii, 17].

HANCOCK (G. L. R.). **Some Records of Uganda Mosquitoes and the oecological Associations of their Larvae.**—*Bull. Soc. roy. ent. Egypte*, 1930, fasc. 1, pp. 38–56, 5 pls., 26 refs. Cairo, 1930.

In this paper the author summarises his initial work on the mosquitos of Uganda, with a view to its use as a basis for future investigations. Various ecological factors are discussed. As regards fish, a species of *Haplochromis*, previously mentioned [*R.A.E.*, B, xvi, 27] appears only to attack the larvae in the absence of other food. *Haplochilus* sp. seems likely to be of more value ; it consumes large numbers of larvae

under laboratory conditions, as does *Barbus* sp., which, however, does not live so near the surface of the water. Observations in the field suggest that a high concentration of iron, or some factor associated with it, renders water unsuitable for local species of Anophelines and indicate the value of experiments to determine whether the addition of iron, possibly in the form of a common local soil, can be made a means of inhibiting the development of Anopheline larvae. The mosquitos observed are discussed under the various types of breeding-place. In open puddles, rock holes and newly-dug brick pits, *Anopheles gambiae*, Giles, was very abundant, but was less numerous in open wells (water-holes) and open puddles along the beds of streams. A single doubtful record is given of *A. transvaalensis*, Cart., from a pool in a rock crevice. In wells with overhanging banks and partly overgrown brick pits, *A. gambiae* is often found in association with *A. funestus*, Giles, both occasionally in large numbers, though *A. funestus* is usually the more abundant. In one case *A. theileri*, Edw., predominated and was occasionally associated with *A. gambiae* and *A. funestus*. *A. mauritianus*, Grp., is scarce in breeding-places of this type. At the grass-shaded edges of stagnant or slowly flowing streams or ditches and at the borders of swamps where cultivation ends, *A. gambiae* and *A. funestus* occur in varying numbers. *A. mauritianus* is not uncommon, either alone or in association with the other two species. *A. squamosus*, Theo., is rare, and *A. theileri* was recorded once. In swamps, including those dominated by papyrus, *Saccharum* and other aquatic grasses, *A. mauritianus* predominates; *A. funestus* sometimes occurs in association with this species, but has not been found among papyrus. *A. implexus*, Theo., was found in dense shade near the roots of palms in open swamps.

The adults of *A. gambiae* and *A. funestus* were taken in European houses and native huts; *A. transvaalensis* and *A. marshalli* in houses; *A. theileri* and *A. implexus* in huts; and *A. mauritianus* and *A. marshalli* in tents. Among the adult Culicines taken in dwellings, *Aëdes argenteus*, Poir., was common. Dissections of *A. gambiae*, *A. funestus* and *A. theileri* showed malaria infection in the first two species, a high rate being indicated, but only one doubtful infection was found in the few dissections made of the last species.

In an appendix a list is given of the mosquitos in the catalogue of the Agricultural Laboratories; Anophelines not recorded above are *A. pharoensis*, Theo., *A. christyi*, Newst., *A. rhodesiensis*, Theo., and *A. pitchfordi*, Giles.

MOUTIA (A.). **Flies injurious to Domestic Animals in Mauritius.**—*Bull. Dept. Agric. Mauritius*, Sci. Ser., no. 15, 8 pp., 2 pls. Réduit, 1930.

Chrysomyia putoria, Wied., and *Sarcophaga haemorrhoidalis*, F., all stages of which are described, are probably the only two flies that cause myiasis in domestic animals in Mauritius, the former being responsible for 97–98 per cent. of the cases. The manner in which different animals are attacked is described. *C. putoria* is closely related to *C. albiceps*, Wied., a serious pest of sheep in South Africa, and its bionomics are similar. The eggs are laid in batches of 100–150. In the summer the egg stage lasts 12–18 hours, and the larval and pupal stages about 5 days each, and in the insectary egg-laying began 11–13 days after emergence.

S. haemorrhoidalis is viviparous; the larvae are usually deposited on excreta and carrion, and though they may infest sores or wounds that are not properly dressed and cause serious lesions, this is considered purely accidental. They have also been held responsible for intestinal myiasis. On an average from 80 to 100 larvae are deposited by one female during the course of from 2 to 3 hours, a batch of 10–15 larvae being extruded at a time. The larval stage lasts 4–5 days, and the pupal period 12–13. Egg-laying begins 7 days after emergence. The adults are most numerous after heavy rains.

The usual measures against blow-flies and methods of treating the wounds caused by them are briefly described.

Further investigations on *Stomoxys nigra*, Macq. [*cf. R.A.E.*, B, xvii, 20] have shown that the fly causes ophthalmia in cattle. In certain herds, 20 per cent. of the animals are affected. The fly usually attacks the eyelids and the animals become nearly blind in about 12 days, feed with difficulty and lose condition rapidly. In some cases the sight is not recovered. The treatment consists of placing the animal in a dark, fly-proof shelter, and washing the eyes daily with a lukewarm 2 per cent. solution of boracic acid, and dropping carefully into them a lotion of silver nitrate, 1 : 300, or 1 per cent. zinc sulphate. The fly may be held in check by the use of a trap already noticed [xviii, 90].

CARPANO (M.). **La Peste Equina con particolare riguardo a quella osservata in Egitto e in Eritrea.** [African Horse Sickness, with special Regard to that observed in Egypt and Eritrea.]—*Clinica vet.*, liii, nos. 6–8, pp. 325–341, 391–401, 471–484, 2 pls., 30 refs. Milan, June–August 1930.

In July 1929 fatal cases of African horse sickness occurred in Upper Egypt, the disease having probably come from the Sudan. Its clinical aspects are discussed. It is caused by an ultrafiltrable virus, and the views of various workers as to probable vectors are recorded. Observations in Eritrea and Egypt suggest that it is transmitted by *Anopheles* and *Aëdes* (*Stegomyia*), as these mosquitos are numerous in all the localities where it occurs, and it is prevalent in the same places and seasons as malaria. In Eritrea the natives believe that the same mosquito transmits both diseases, and it is possible that *Anopheles* is responsible for its local transmission, and *Aëdes* for its spread, since the species of the latter genus are often carried in trains, boats, etc. *Culex* is abundant in the High Plateau of Eritrea, but no spontaneous cases of horse sickness have occurred there, despite the importation of infected equines, so that it is doubtful whether the species of this genus are vectors.

LARROUSSE (F.). **Description de l'*Hypoderma corinnae* Crivelli, 1862 (imago).**—*Arch. Inst. Pasteur Algerie*, vii, no. 2, pp. 217–219, 1 pl. Algiers, June 1929. [Recd. 1930.]

One adult female was successfully bred from larvae of *Hypoderma corinnae*, Crivelli, taken on *Gazella dorcas* in a locality 50 miles west of Biskra. Although it was immature and probably imperfect in colouring, a sufficient number of fixed characters to admit of future identification of the species are described. The larva was originally described in 1862 and has since been frequently recorded, always from the same host, but no adult had hitherto been obtained.

CASE (L. I.). **Studies on the Ox Warble Flies, *Hypoderma lineatum* and *Hypoderma bovis*, with special Reference to economic Importance and Control.**—*Tech. Bull. Virginia Agric. Expt. Sta.*, no. 39, 12 pp., 2 figs., 8 refs. Blacksburg, Va., September 1929. [Recd. 1930.]

A brief general account is given of *Hypoderma lineatum*, Vill., and *H. bovis*, DeG., including notes on their bionomics, distribution, economic importance and control and a summary of the characters distinguishing the two species [*cf. R.A.E.*, B, xiv, 163]. Studies carried out from 1926 to 1929 in south-western Virginia, where both species are prevalent, showed that young cattle are generally more heavily infested than older ones. The adults appear on the first warm days in April and reach their maximum in June and July in a normal season. Larvae appear in the subcutaneous tissues of the back about 1st December, and begin to emerge and pupate about the middle of January. The life-cycle is 4–6 weeks earlier in *H. lineatum* than in *H. bovis*, and the control of the latter has been less efficient, owing to neglect of extractions in April and May, when the cattle have been turned out to summer range. Salt, whether wet or dry, has been found to be ineffective as a dressing against the larvae in the subcutaneous tissues of the host, but benzene, injected into the larval cysts, effects a high percentage of kill. Hand extraction, repeated 5 times at intervals of 30 days, is a practical and effective means of control, but care should be observed to avoid the bursting of larvae or cysts, which is liable to cause anaphylaxis. These control measures have effected a reduction of 50 per cent. in the infestation, and the increased weight and milk production in the cattle treated has given an adequate return for the labour involved. Owing to the ability of the flies to travel a considerable distance, measures must be carried out on co-operative lines and closely supervised.

[FILIP'EV (I. N.).] **Филипьев (И. Н.). Report of the Division of applied Entomology.** [*In Russian.*]—*Ann. Rep. St. Inst. Exptl. Agron. 1928–29*, pp. 169–198. *Izv. Gosud. Inst. opuitn. Agron.*, 1929, no. 6, suppl. Leningrad, 1930.

The work carried out by the sub-section for the study of pests of domestic animals is briefly reviewed on pp. 189–190. During the year ending 1st October 1929, 23 species of Tabanids were recorded in the Leningrad Government. These may be divided into two groups, of which the adults are active from the end of May till July, and in July–August, respectively. The flight period of *Tabanus* spp. lasts about five weeks; that of *Chrysops caecutiens*, L., and *Haematopota pluvialis*, L., covers a period of about two months. The lowest temperature at which flight occurs is 15° C. [59° F.].

VON IHERING (R.). **Os Oestrideos importados, seu papel como parasitas e em particular os *Gastrophilus* no Brasil.** [Imported Oestrids, their Rôle as Parasites, particularly *Gastrophilus*, in Brazil.]—*Bol. Agric. S. Paulo*, xxx, no. 11–12, pp. 863–883, 10 figs., 7 refs. S. Paulo, 1929. Also in *O Campo*, i, no. 6, pp. 62–67, 10 figs., 7 refs. Rio de Janeiro, June 1930.

Of the various Oestrids harmful to mammals, *Dermatobia hominis*, Say, is indigenous in Brazil. *Gastrophilus nasalis*, L., which infests

horses, is the only exotic species known to be established in that country. Keys are given to the larvae and females of *G. nasalis*, *G. intestinalis* DeG., *G. pecorum*, F., and *G. haemorrhoidalis*, L., with notes on their bionomics and distribution. Animals are apprehensive of infestation by Oestrids and endeavour to escape their attacks, and it is suggested that this is why *D. hominis* no longer oviposits directly on its host but has its eggs carried by other Diptera [*R.A.E.*, B, xviii, 186, etc.].

Talice (R. V.). **Sur la trombidiose humaine en Uruguay.**—*Ann. Parasit. hum. comp.*, viii, no. 3–4, pp. 349–354, 13 refs.

André (M.). **Sur une larve d'acarien parasite de l'homme et des animaux en Uruguay, appartenant au genre** *Thrombicula* **Berlese.** —*T.c.*, pp. 355–361, 3 figs., 2 refs. Paris, 1st July 1930.

Infestation of man by harvest mites is widespread during the summer in Uruguay, but the mites live only a few days on the skin of the victim, and the symptoms caused are never serious, though they may persist for a few days after the mite has been extracted. The possible identity of the mite concerned is discussed. Various authors have suggested that it is one or other of certain species that normally infest plants, but though some of them might accidentally infest man, it is improbable that they could produce symptoms similar to those caused by harvest mites. All the larvae that the author has obtained from man in Uruguay belong to a variety of *Trombicula irritans*, Riley. This larva is described by André in the second paper as *T. irritans* var. *uruguayensis*, n. It has also been taken from a rodent, *Cavia aperea*, a lizard, *Teius teyou*, and a bird, *Nothura maculosa* [*cf. R.A.E.*, B, xviii, 13], and closely resembles *Microtrombidium brumpti*, Lahille [xvi, 78], the types of which have been lost.

Nitzulescu (V.). **Sur le** *Phlebotomus chinensis*.—*Ann. Parasit. hum. comp.*, viii, no. 3–4, pp. 362–375, 11 figs., 10 refs. Paris, 1st July 1930.

A detailed description, based on the averages of a series of measurements, and carefully compared with previous descriptions, is given of the anatomy of both sexes of *Phlebotomus chinensis*, Newst.

Nitzulescu (V.). **Sur la présence en Europe du** *Phlebotomus major* **s. str.**—*Ann. Parasit. hum. comp.*, viii, no. 3–4, pp. 376–381, 5 figs., 2 refs. Paris, 1st July 1930.

Phlebotomus neglectus, Tonnoir [*R.A.E.*, B, x, 8], is considered a synonym of *P. major*, Ann. New characters are added to the description of this sandfly, and it is recorded from 3 new localities, in Dalmatia, Albania and the Dardanelles, the two latter records indicating the course of its passage from Asia Minor into Europe. The author considers the differences between *P. major* and *P. perniciosus*, Newst., to be sufficiently pronounced to render them specifically distinct [*cf.* xvii, 30].

Nitzulescu (V.). **Sur une variété de** *Phlebotomus perniciosus.*—*Ann. Parasit. hum. comp.*, viii, no. 3–4, pp. 382–385, 4 figs. Paris, 1st July 1930.

A variety of *Phlebotomus perniciosus*, Newst., is described from Douar-Shott, Tunis, but not named.

Nitzulescu (V.). **Sur le** *Phlebotomus troglodytes* **et le** *Phlebotomus brumpti.*—*Ann. Parasit. hum. comp.*, viii, no. 3–4, pp. 386–393, 10 figs., 3 refs. Paris, 1st July 1930.

Characters are described distinguishing *Phlebotomus troglodytes*, which was named but not described by Lutz [*cf. R.A.E.*, B, x, 200], and *P. brumpti*, Larrousse.

Feytaud (J.). **Les Puces.**—*Rev. Zool. agric.*, xxix, no. 2, pp. 21–36, 7 figs., 24 refs. Bordeaux, February 1930.

This popular account of fleas, particularly with regard to their relation to man, includes a discussion of measures that have been recommended for their control, and a brief review of the species associated with plague in various parts of the world.

[Kuzenkov (V. I.).] **Кузенков (В. И.). Zum Studium der Fauna der Flöhe (Aphaniptera) des endemischen Pestrayons des Nord-Kaukasischen Gebietes.** [Contribution to the Study of the Fauna of Fleas (Aphaniptera) of the endemic Plague Region in North Caucasus. (*In Russian.*)]—*Izv. Gosudarstv. Mikrobiol. Inst. Rostov-na-Donu*, pt. 9, pp. 106–125, 1 map, 3 refs. Rostov-on-Don, August 1929. (With a Summary in German, pp. 167–168.) [Recd. 1930.]

This paper deals with the fleas collected on a variety of animals during the years 1926–28 in the eastern part of the Salsk district in the northern Caucasus, the species and their hosts being shown in a table. The material consisted of 26,371 individuals belonging to 11 different genera and 17 species, a list of which is given. Most of the fleas were obtained from *Citellus pygmaeus*, *Neopsylla setosa*, Wagn., and *Ceratophyllus tesquorum*, Wagn., being the prevalent species, the former in the nests and the latter on the host. *Ctenophthalmus pollex*, Wagn. & Ioff, and *C. orientalis*, Wagn., occurred in certain localities only and were never found together.

Fleas taken on man in addition to *Pulex irritans*, L., were *C. tesquorum* in two cases and *Mesopsylla hebes*, J. & R., which is normally a parasite of jerboas, in one case. The possibility of such fleas attacking man may be of interest in relation to the epidemiology of plague.

[Ioff (I.) & Pokrovskaya (M.).] **Иофф (И.) и Покровская (М.). Experimente mit Flöhen der menschlichen Wohnungen als Trägern der Pestinfektion.** [Experiments with Fleas of human Dwellings as Carriers of Plague Infection. (*In Russian.*)]—*Izv. Gosudarstv. Mikrobiol. Inst. Rostov-na-Donu*, pt. 9, pp. 126–136, 1 pl., 1 ref. Rostov-on-Don, August 1929. (With a Summary in German, pp. 168–170.) [Recd. 1930.]

The fleas used in these experiments were *Pulex irritans*, L., *Ctenocephalides* (*Ctenocephalus*) *canis*, Curt., and *C.* (*C.*) *felis*, Bch. It was

found that humidity is essential for keeping them, as the majority of those in empty glass jars in a room died within the first 24 hours, only a few surviving 2–3 days. The best method was to keep them in test tubes with a layer of damp sand 1–2 cm. deep at the bottom. The tubes were closed with a cotton-wool stopper and placed in a box containing wet rags so as to maintain an air humidity of 70–90 per cent. and a temperature of 5–15° C. [41–59° F.]. Under these conditions the maximum and average periods of survival in days were 18 and 7 for *C. canis*, 36 and 10 for *C. felis*, and 34 and 19 for *P. irritans*. Fleas of rodents kept under identical conditions lived for months.

In experiments with plague the fleas were given an initial feed on an infected guineapig, and some were subsequently fed on healthy guineapigs. All the three species easily became infected, *Bacillus pestis* being numerous in the digestive tract, and occurring in the faeces 24–144 hours after the fleas had been fed. The plague infection remained in the fleas until their death, whether they were re-fed or not, the periods involved being 6 days in the case of *C. canis*, 23 in that of *C. felis*, and 22 in that of *P. irritans*. These facts are of importance in relation to the disinfection of houses that have been occupied by persons infected with plague and the time that should elapse before they may again be inhabited.

It is pointed out that cultures of infected fleas must be made within 24 hours of their death, as otherwise they usually dry up and no plague bacilli are obtained.

Brug (S. L.), Haga (J.), van Joost (R. P. A. C.) & Verbunt (J. A. M.). **Scabies crustosa s. Norvegica.**—*Geneesk. Tijdschr. Ned.-Ind.*, lxx, no. 6, pp. 576–587, 2 pls., 1 fig., 14 refs. Weltevreden, 1st June 1930.

A case of Norwegian crusted scabies in the Dutch East Indies is described. The authors compare the characters of the mite concerned with those of various species or forms of *Sarcoptes* recorded from man and animals, but are unable to identify it definitely with any one of them rather than another and record it as *S. scabiei*, L.

Papers noticed by Title only.

Deeks (W. E.). **Progress in Malaria Control.**—*18th Ann. Rep. Med. Dept. United Fruit Co., 1929*, pp. 98–103, 3 refs. Boston, Mass., 1930. Also in *J. Trop. Med. & Hyg.*, xxxiii, no. 8, pp. 101–103. London, 15th April 1930.

Missiroli (A.). **Ricerche sui flagellati che si riscontrano nell'***Anopheles maculipennis*. [Researches on the Flagellates found in *A. maculipennis*.]—*Riv. Malariol.*, ix, no. 2, pp. 111–119, 2 pls., 4 refs. Rome, 1930. (With Summaries in Italian, p. 201, French, p. 203, English, p. 205, German, p. 207.)

Leeson (H. S.). **A new Variety of** *Anopheles funestus*, **Giles, from Southern Rhodesia** [var. *fuscivenosus*].—*Bull. Ent. Res.*, xxi, pt. 2, pp. 125–126, 1 fig. London, July 1930.

Marshall (J. F.). **A new Form of Apparatus for photographing Insects.**—*Bull. Ent. Res.*, xxi, pt. 2, pp. 139–140, 2 pls. London, July 1930.

King (W. V.). **Recent Observations on Malaria and Anophelines in the Philippines.**—*Southern Med. J.*, xxiii, no. 5, pp. 445–447, 5 refs. Birmingham, Ala., May 1930. [*Cf. R.A.E.*, B, xvii, 64.]

da Costa Lima (A.). **Sobre os mosquitos que se criam em buracos de arvores.** [On Brazilian Mosquitos breeding in Tree-holes.]—*Mem. Inst. Oswaldo Cruz*, xxiii, no. 5, pp. 255–260, 2 figs., 2 pls., 8 refs. Rio de Janeiro, 1930.

Medschid (—). *Culex martinii* **n. sp.** [from Asia Minor].—*Arch. Schiffs- u. Tropenhyg.*, xxxiv, no. 7, pp. 364–369, 4 figs. Leipzig, July 1930.

Bock (F.). **Versuche über den Gaswechsel bei Insekten und deren Bedeutung für Fragen der angewandten Entomologie.** [Experiments on respiratory Gas Exchanges in Insects (Pupae of *Calliphora vomitoria*, L., and *Lucilia caesar*, L.) and their Significance in Questions of applied Entomology.]—*Z. angew. Ent.*, xvi, no. 2, pp. 357–376, 9 figs., 16 refs. Berlin, May 1930. [*Cf. R.A.E.*, B, xvi, 1.]

Ussing (H.). **Kvaegmyggene (Simuliidae).** [Contribution to the Biology and Ecology of the Danish Species of *Simulium*.]—*Naturens Verdens*, xi, pp. 249–266, 11 figs. Copenhagen, 1927.

Henriksen (K. L.). **Oksebremsens Biologi.** [Biology of *Hypoderma bovis*, DeG.]—*Naturens Verden*, xi, pp. 162–180, 13 figs. Copenhagen, 1927.

Stone (A.). **The Bionomics of some Tabanidae (Diptera)** [in U.S.A., including Descriptions of the Larva and Pupa of 11 Species of *Chrysops*, 1 of *Goniops* and 12 of *Tabanus*].—*Ann. Ent. Soc. Amer.*, xxiii, no. 2, pp. 261–304, 12 figs., 51 refs. Columbus, Ohio, June 1930.

Navarro de Andrade (E.). **Pesquizas sobre o berne.** [Investigations on Infestations of domestic Animals in S. Paulo by *Dermatobia hominis*, Say.]—*O Campo*, i, no. 1, pp. 56–57, 1 fig. Rio de Janeiro, January 1930. [See *R.A.E.*, B, xvii, 53; xviii, 67.]

Lloyd (Ll.) & Paisley (J. C.). **Note on an Attempt to estimate the Number of Trypanosomes injected by an Infective Tsetse.**—*W. Afr. Med. J.*, iii, no. 2, pp. 31–32, 2 refs. Lagos, October 1929. [See *R.A.E.*, B, xviii, 203.]

Turner (A. W.) & Murnane (D.). **A preliminary Note on the Occurrence of *Trypanosoma theileri* in the Blood of Cattle in Victoria.**—*Aust. J. Exptl. Biol. Med. Sci.*, vii, pt. 1–2, pp. 9–11, 1 pl., 8 refs. Adelaide, 16th June 1930.

Stewart (M. A.). **Notes on North American Ceratophylli (Siphonaptera).**—*Canad. Ent.*, lxii, no. 7, p. 152. Orillia, Ont., July 1930.

Carrión (A. L.). **Third Report on a Rat-flea Survey of the City of San Juan, Porto Rico.**—*Publ. Hlth. Rep.*, xlv, no. 27, pp. 1515–1520, 7 charts. Washington, D.C., 4th July 1930. [*Cf. R.A.E.*, B, xviii, 163.]

[Mar'ina (Yu. N.).] **Марьина (Ю. Н.). Beobachtungen über die Lebensfähigkeit der Flöhe von Haustieren unter Laboratoriumsbedingungen.** [Observations on the Survival of Fleas of domestic Animals under Laboratory Conditions. (*In Russian.*)]—*Izv. Gosudarstv. Mikrobiol. Inst. Rostov-na-Donu*, pt. 9, pp. 153–155. Rostov-on-Don, August 1929. (With a Summary in German, p. 172.) [Recd. 1930.]

[Ioff (I.) & Pokrovskaya (M.).] **Иофф (И.) и Покровская (М.). Beobachtungen über die Pestinfektion der Zieselflöhe während der Epizootie im Jahre 1928.** [Observations on the Infection of the Fleas of Ground Squirrels during the Plague Epizootic in 1928. (*In Russian.*)]—*Izv. Gosudarstv. Mikrobiol. Inst. Rostov-na-Donu*, pt. 9, pp. 138–152, 5 pls. Rostov-on-Don, August 1929. (With a Summary in German, pp. 171–172.) [Recd. 1930.]

This paper is the first of a proposed series on the infection with plague of the fleas of ground squirrels (*Citellus*) under natural conditions, and deals with observations carried out in the endemic region in the northern Caucasus in the summer of 1928 during an epizootic.

The method of collecting the fleas from the dead animals and their nests, and the technique of dissecting them and preparing cultures from them are described. An average of 2–3 fleas occurred on each dead ground squirrel, 6 per cent. being *Neopsylla setosa*, Wagn., and 94 per cent. *Ceratophyllus tesquorum*, Wagn. Of the fleas collected, 63 per cent. were infected with plague, the vast majority being *C. tesquorum*. As this species is the specific parasite of ground squirrels, is able to transmit plague, and readily attacks man [*R.A.E.*, B, xiv, 66; xvi, 220], the authors consider it to be chiefly responsible for epizootics and epidemics in the region, especially in view of the fact that it increases in abundance in May–July, which coincides with the development of epizootics among the ground squirrels. Experiments indicated, however, that fleas cannot live long in the open away from their hosts under the conditions of extreme heat and dryness of the air and soil in the steppe.

[Vasil'ev] Wassilieff (A.). **Observations sur les puces de la région du Cayor. (Note préliminaire.)**—*Bull. Soc. Path. exot.*, xxiii, no. 5, pp. 474–478, 1 fig. Paris, 1930.

During a study of plague conditions in Cayor (Senegal), the fleas taken in native dwellings amounted to 300 a day in some huts. At first they were trapped by means of a dish of ground-nut oil in which floated a night light, but it was subsequently found that they could be caught in large numbers in dishes of water, to which chloroform was occasionally added, these being effective even by day. *Xenopsylla cheopis*, Roths., was much the most numerous in huts and on rats, on which *Ctenocephalides* (*Ctenocephalus*) *canis*, Curt., and *C.* (*C.*) *felis*, Bch., were sometimes found in smaller numbers, and very occasionally *X. astia*, Roths. This last has not previously been recorded from French West Africa. Rats in the neighbourhood of poultry yards were heavily infested with *Echidnophaga gallinacea*, Westw. *Pulex irritans*, L., was never encountered in the course of this survey, though a few individuals were found on both rats and man at Saint-Louis. In a village where plague was epidemic among the population and an epizootic occurred among hares, jackals, etc., in January 1928, the population was evacuated and the dwellings burnt. Four months later, when the area was visited, living individuals of *X. cheopis* were found on the mummified bodies of rats beside their holes, no living rats being observed. This bears out laboratory findings that with suitable temperature and humidity fleas can live for 13 months. The author has kept *E. gallinacea* alive in the laboratory without food for at least four months from the time when it had reached the adult stage.

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BOUFFARD (G.). **Considérations au sujet de la transmission de la peste.**—*Bull. Soc. Path. exot.*, xxiii, no. 5, pp. 455–456.

BOUFFARD (G.). **Au sujet de l'étiologie de la peste.**—*T.c.*, no. 6, pp. 563–564. Paris, 1930.

During July 1921 pneumonic plague, introduced into Tananarive by rail from Tamative, existed in this form for 40 days. After a period of absolute quiescence of three months, it reappeared in bubonic form and at the same time was observed in rats. The pneumonic form is spread essentially from man to man during a period when rats are still uninfected. When the rat becomes infected, bubonic and septicaemic plague appear. During the last hours of life in septicaemic cases the plague bacilli are so numerous in the peripheral blood that the blood sucked up by a biting insect may be assumed to be very rich in them. It is suggested that the rat flea, *Xenopsylla cheopis*, Roths., may become an accidental parasite of man for a sufficiently long time for transmission from man to man to enter into play in certain clinical forms of the disease, particularly in septicaemic plague, and may maintain the disease for a sufficiently long period to allow of the infection of rats if these exist in the locality. The importance of *Pulex irritans*, L., in transmission from man to man requires further study. In any case in addition to measures designed to prevent the importation of rats into a country free from plague, precautions should be taken to deal with the possible arrival of passengers in the incubation stage of the disease. For five years natives arriving in the Ivory Coast from endemic plague centres have been passed through an observation camp, and two cases in 1927 were found to be infected. Thus a native in the incubation period of the disease may arrive from a distance at a place free from plague and create a human centre of the disease, which may extend to the rat population and so create a definitely endemic focus.

LEGER (M.). **Rôle non exclusif des rats comme réservoirs du virus de la peste.**—*Bull. Soc. Path. exot.*, xxiii, no. 6, pp. 564–568, 7 refs. Paris, 1930.

The author refers to various papers in the literature which support the view expressed in the preceding paper that man may act as a carrier of plague and that epizootics and epidemics are not necessarily co-existent. Moreover, plague bacilli have been found to persist in man after his recovery from the disease, and may perhaps invade the peripheral blood when resistance is lowered by some other disease and thus may be ingested by fleas. Nikanorov records the case of a healthy man acting as a carrier of the disease [*R.A.E.*, B, xviii, 93].

MARCANDIER (—) & BIDEAU (—). **Note sur l'épidémiologie de la fièvre exanthématique observée à bord des navires de guerre à Toulon. Rôle possible d'un acarien du rat dans la transmission.**—*Rev. Hyg. Med. prévent.*, lii, pp. 353–364, 2 figs., 9 refs. 1930. (Abstract in *Bull. Hyg.*, v, no. 10, p. 814. London, October 1930.)

The authors discuss the incidence of a fever resembling Marseilles fever in men in ships of the French Mediterranean Squadron, and consider the rat mite, *Dermanyssus muris*, Hirst, to be responsible for

its transmission. Rats and the mite are most numerous in that part of the ship inhabited by those most affected by the disease. All the circumstances facilitating opportunities for contact between man and rats and their parasites favour the development of the fever, which is most frequent in the summer months when the parasites are most numerous. *D. muris* was not found in ships in which the disease did not occur.

Nicolle (C.) & Anderson (C.). **Sur l'adaptation des spirochètes récurrents à des hôtes invertébrés, autres que ceux qui les transmettent dans la nature. Intérêt d'étendre les recherches aux spirochètes récurrents de la République Argentine et des républiques voisines.**—*5. Reun. Soc. argentina Pat. reg. Norte, Jujuy, 1929*, i, pp. 7–9. Buenos Aires, 1930.

The authors review their work on the adaptation of individual relapsing fever spirochaetes to various ticks [*R.A.E.*, B, xvii, 62], in order to stimulate investigation on this subject in Argentina.

The Pigeon Fly.—*42nd Ann. Rep. S. Carolina Expt. Sta., 1928–29*, p. 63. Clemson Coll., S.C., December 1929. [Recd. 1930.]

Brief notes are given on the bionomics and control of the pigeon fly, *Pseudolynchia* (*Lynchia*) *maura*, Big. [*R.A.E.*, B, xviii, 89]. In the laboratory dilutions of carbolic acid and cresol were effective in killing pupae.

Herms (W. B.) & Burgess (R. W.). **A Description of the immature Stages of *Hippelates pusio* Loew and a brief Account of its Life History.**—*J. Econ. Ent.*, xxiii, no. 3, pp. 600–603, 4 figs., 3 refs. Geneva, N.Y., June 1930.

Hippelates pusio, Lw., has increased alarmingly in recent years in California, where it is believed to transmit conjunctivitis [*R.A.E.*, B, xvii, 99] and also causes great annoyance to labourers in the field, particularly those engaged on hand pollination of dates and picking of fruit. A sum of £2,400 was voted by Congress early in 1929 for investigations in connection with the fly, and numerous traps consisting of large canvas frames have been placed in various situations to catch any adults that might emerge in the area covered by them. The immature stages have not yet been taken under field conditions, but eggs were discovered in May 1929 in a pint jar containing, together with trapped living flies, water-soaked shredded brown fibre from corrugated cardboard packing cases. Since then they have been repeatedly secured in jars containing soaked wheat straw and chaff. The entire life-history in the laboratory, with the temperature ranging from 80 to 105° F., required about 3 weeks. The egg, larva and puparium are described.

Swezey (O. H.). **Entomology.**—*Rep. Comm. Expt. Sta. Hawaiian Sugar Pl. Ass. 1928–29*, pp. 16–25. Honolulu, 1930.

In New Britain, the larvae of *Megarhinus inornatus*, Wlk., which does not suck blood, are predacious on those of other mosquitos in

water in rot-holes in trees, tanks, roof gutters, etc., that is, in the same habitats as the larvae of the noxious day-flying mosquitos of Hawaii. It is primarily a forest species, but consignments have been introduced and liberated in the heavily shaded parts of Hawaii, and the present indications are that it is likely to become established.

The Mexican dung beetle, *Copris incertus* var. *prociduus*, Say, seems to be spreading on Maui, where it was introduced, and it has been collected for distribution to the other Islands. Whether it will ever become sufficiently numerous to scatter the cow dung and thus prevent breeding of the hornfly [*Lyperosia irritans*, L.] is not yet known.

KEMPER (H.). **Neue Gesichtspunkte zur Bekämpfungsbiologie der Bettwanze.** [New Points of View on the Biology of the Bed-bug in Relation to its Control.]—*Z. Desinfekt.*, xxii, no. 5, pp. 406–410, 5 refs. Dresden, May 1930.

Though the rate of reproduction of *Cimex lectularius*, L., is comparatively low, it is highly resistant to unfavourable conditions, such as starvation and variations of temperature, and this constitutes the chief difficulty in measures against it.

PEUS (F.). **Zur Biologie der Hausmücke, *Culex pipiens* L., während der Wintermonate.** [On the Biology of the domestic Mosquito during the Winter Months.]—*Z. Desinfekt.*, xxii, no. 5, pp. 410–414, 2 refs. Dresden, May 1930.

In these experiments, which were carried out near Berlin, hibernating individuals of *Culex pipiens*, L., resumed their activity when kept at a warm temperature, and feeding, oviposition and development proceeded in a normal manner. There was no evidence of obligatory asthenia [*cf. R.A.E.*, B, xvii, 108; xviii, 9]. The winter rest of this mosquito, therefore, depends only on external factors, perhaps a decrease in temperature. This agrees with observations in nature, where reproduction and the renewal of generations continue into late October, being suspended only by the advent of cold nights, and in a hospital in the Ruhr district where owing to the heating the mosquitos proved most troublesome throughout the severe winter of 1928–29.

BUCHMANN (W.). **Versuche zur quantitativen Wertbestimmung von Pyrethrum-Insektpulvern durch den physiologischen Tierversuch.** [Experiments for the quantitative Determination of the Value of Pyrethrum Insect Powders by Means of physiological Tests with Insects.]—*Z. Desinfekt.*, xxii, no. 5, pp. 414–418, 3 refs. Dresden, May 1930.

In these experiments with an extract of a proprietary pyrethrum powder, the insects used were cockroaches, *Cimex lectularius*, L., and *Musca domestica*, L. The gradual effect on the nervous system, leading up to total paralysis, is described. It is claimed that the procedure adopted renders possible an exact physiological grading of pyrethrum insecticides.

Imms (A. D.). **Recent Advances in Entomology.**—Demy 8vo, viii+ 374 pp., 84 figs. London, J. & A. Churchill, 1931. Price 12*s.* 6*d.*

The enormous growth of entomological literature of recent years has rendered it impossible for the individual to keep in touch with all aspects of it, especially as these are themselves increasing both in numbers and complexity.

This book should therefore be of great value in that it summarises in a compact form the more recent additions to knowledge on a number of selected subjects.

The contents comprise two chapters devoted to morphology of insects, one each to metamorphosis and palaeontology, two to the sense organs and reflex behaviour, one to the fundamental aspect of coloration, four to some aspects of ecology and to its practical application, and two each to parasitism and biological control. A short, but well selected, bibliography is appended to each.

Hegner (R.) & Andrews (J.) Ed. **Problems and Methods of Research in Protozoölogy.**—Demy 8vo, ix+532 pp., 32 figs., 45 pp. refs. New York, etc., The Macmillan Co., 1930. Price 21*s.* net.

This work, in which a number of authors are concerned, is primarily written for the protozoologist, but it also contains a number of chapters of interest to the entomologist. These include: The Protozoa of Termites, by H. Kirby, jr. (pp. 32–48); Transmission of intestinal Protozoa, by R. Hegner (pp. 73–84); Blood-inhabiting Flagellates in general, by J. Andrews (pp. 244–247); The intestinal Flagellates of Insects, by E. R. Becker (pp. 248–256); Protozoa of Latex Plants, by F. O. Holmes (pp. 257–275); Malaria in General, by R. Hegner (pp. 348–353); and Laboratory Methods in Malaria: The Infection and Dissection of Mosquitoes, by M. A. Barber (pp. 366–380).

Jaarverslag over 1929 van de Malaria-commissie uit den Gezondheidsraad. [Report for 1929 of the Malaria Commission of the Health Council of Holland.]—*Versl. Meded. Volksgezondheid*, July 1930, reprint 14 pp. [Amsterdam, 1930.]

Regular work against the larvae [of *Anopheles maculipennis*, Mg.] was continued at Alkmaar, Amsterdam and Medemblik in 1929 [*R.A.E.*, B, xvii, 220]. It is estimated that over 2½ million adults were destroyed at Amsterdam. At Medemblik, the treated area [*cf.* xviii, 23] was reduced from a distance of 3 km. [1·86 mile] to 2 km. [1·24 mile] from the protected centre, a reduction of 37 per cent. of the area. The mosquitos were found to be half as numerous in the protected centre as outside the treated area, whereas in 1928 they had been only one-third as numerous.

Report on the Activities of the Public Health Service in Prilep for the Year 1929. [*In Serbian.*]—*Socijalno-Med. Pregled*, i, pt. 3–4, pp. 93–102. Belgrade, 1930.

A section of this report (pp. 97–98) deals with malaria in southern Serbia. The abundance of rainfall throughout the spring, summer and autumn and cold weather in April and May were responsible for

a marked decrease in the numbers of both *Anopheles maculipennis*, Mg., and *A. superpictus*, Grassi, as compared with the preceding year. Both species were present in almost equal numbers in certain stables in which in the previous year *A. superpictus* had been predominant.

[Enikolopov (S. K.).] **Ениколопов (С. К.). The Water Factor and Materials for the Study of the Fauna of Mosquitos in the Region of Makhach-Kala.** [*In Russian.*]—*Trop. Med. Vet.*, viii, no. 3, pp. 23–31, 3 refs. Moscow, March 1930.

Of the mosquitos abundant in and near the town of Makhach-Kala (Daghestan) on the Caspian Sea, the Anophelines found during June–October 1928 were *Anopheles maculipennis*, Mg., *A. hyrcanus*, Pall., *A. hyrcanus* var. *pseudopictus*, Grassi, *A. bifurcatus*, L., *A. algeriensis*, Theo., *A. sacharovi*, Favr, *A. martinius*, Shing., and occasionally *A. superpictus*, Grassi.

The topography of the district is discussed; numerous swamps, together with neglected drainage ditches and other natural and artificial collections of water covered with weeds offer ideal conditions for the breeding of *A. maculipennis*. The various types of waters in which the larvae of this mosquito were found are described; the pH content varied from 6·8 to 8·4. The larvae were invariably present where Confervaceae occurred, although in some instances the water was highly polluted, but none was found in heavily shaded waters devoid of submerged vegetation. The larvae of the third generation, which occurred in August, were specially abundant; the development of the fourth was greatly checked by cold weather, and only a few adult mosquitos were found in October. Adult Anophelines were much more numerous in animal quarters than in houses, and in several instances the presence of horses and cattle appeared to protect man from their attacks.

Phlebotomus papatasii, Scop., and *P. perniciosus*, Newst., were also found in houses and a stable in the town, and in three villages.

[Gritzai (P. K.) & Tishchenko (O. D.).] **Грицай (П. К.) та Тищенко (О. Д.). The Presence of pH in Water Reservoirs as an Index of their Suitability for the Breeding of the Larvae of *Anopheles maculipennis* Meig.** [*In Ukrainian.*] *Sanit.-ent. Byull.*, i, no. 3, pp. 3–12, 15 refs. Kharkov, 1930.

An account is given of preliminary studies near Kharkov in 1928 of the physico-chemical composition of various types of water and its bearing on the presence of the larvae of *Anopheles maculipennis*, Mg. Samples of water from a variety of sources were analysed. The larvae were found only at a pH of 6·8–7·6, in waters that were not polluted or devoid of vegetation [*cf. R.A.E.*, B, xiii, 109], being particularly numerous at 7·0–7·6 [*cf.* xviii, 110]. It is probable that the index of pH 6·2–6·6 is a result of pollution and high acidity of the water. All the reservoirs in which the pH was 8·0–8·4 also contained decaying organic matter. The determination of pH may be recommended as a simple method for finding out whether a reservoir of water is likely to favour or prevent Anopheline breeding.

[Yatzenko (F. I.), Rosenberg (R. M.) & Tishchenko (O. D.).] **Яценко (Ф. И.), Розенберг (Р. М.) та Тищенко (О. Д.). Contribution to the Study of the Number of maxillary Teeth of *Anopheles maculipennis* Meig., in Connection with the Analysis of the Type of Blood by Means of the Precipitin Test.** [*In Ukrainian.*]—*Sanit.-ent. Byull.*, i, no. 3, pp. 16–19. Kharkov, 1930.

Following previous work on the relation existing between the number of maxillary teeth of *Anopheles maculipennis*, Mg., and its tendency to attack animals [*R.A.E.*, B, xvi, 212], the authors have examined the maxillary index of mosquitos captured in Kharkov and its environs, the results obtained being different from those of Roubaud [x, 53, 101 ; xvi, 210 ; xviii, 145]. The majority of females that had fed on cattle had 14 or 15 teeth on each maxilla, whereas most of those that had attacked man had 16 or more teeth, and of the mosquitos that had fed on both man and animals, the greater proportion possessed 15 teeth. It is suggested that there is no connection between the maxillary index and the feeding habits of the Anophelines. The analysis of the mixed blood in the stomachs of females that had fed on man as well as domestic animals, indicated, however, that although the mosquitos were captured in places with a dense human population and a scarcity of animals, the percentage of the attacks on man was only 24·22, preference being shown for animals in the following order: cattle 42·21 per cent., horses 20·72 per cent., and pigs 12·85 per cent. The character of the quarters where the Anophelines were collected is discussed, and it is pointed out that everywhere they preferred to feed on animals rather than man, where the former were sufficiently numerous. Although in factory suburbs near breeding-places of Anophelines a certain amount of malaria occurred in quarters where domestic animals were present, the percentage of cases was always lower than in places where there was a complete absence of the animals ; and the incidence of infection was very low in villages and on farms with a sufficient number of cattle, etc.

[Bilyĭ (—).] **Білий (—). Observations on the Effect of Paris Green on the Larvae of *Anopheles maculipennis* Meig.** [*In Ukrainian.*] —*Sanit.-ent. Byull.*, i, no. 3, pp. 19–21. Kharkov, 1930.

The advantages of Paris green over oil against Anopheline larvae are discussed, and recommendations for its application are given. Experiments on the river Dnieper showed that cattle can safely drink water dusted with Paris green, as they dip their muzzles deep below the surface. Dogs and ducks, however, which drink from the surface, were poisoned.

[Chaĭkivs'kiĭ (A. G.).] **Чайківський (А. Г.). Contribution to the Study of intestinal Myiasis.** [*In Ukrainian.*]—*Sanit.-ent. Byull.*, i, no. 3, pp. 21–28. Kharkov, 1930.

This is a review from the literature of the Diptera that cause intestinal myiasis in man owing to the larvae being carried into the digestive tract with food.

[Maslov (A. V.).] Masslow (A. W.). **Zur Biologie der** *Anopheles maculipennis* **Mg.**—*Z. angew. Ent.*, xvi, no. 3, pp. 592–596. Berlin, August 1930.

Observations at Tomsk, Siberia, have shown that in winter (October–February) *Anopheles maculipennis*, Mg., is usually found on the ceilings of rooms, whereas in spring (March–April) it is usually on the walls closer to the floor. Detailed records indicate that differences in temperature are not the cause. On the other hand, tests showed that in December at 4° C. [39·2° F.] the relative humidity at the ceiling was 80 per cent., and near the floor 65, whereas in April at 10° C. [50° F.] the corresponding figures were 70 and 85. Experiments in which all conditions except moisture were similar, made from January to April, showed the average length of life of females of *A. maculipennis* in days to be 24·4 at 65 per cent. humidity, 56·4 at 90 per cent., and 12·5 at 35 per cent.

[**Investigations on Malaria and its Control.**]—*Ann. Rep. Dept. Hlth. Palestine 1929*, pp. 29–35 & 96–102. Jerusalem, 1930.

The work against mosquitos and malaria in Palestine [*cf. R.A.E.*, B, xviii, 188] was continued during 1929. Owing to an unusually high rainfall during the winter, there were ample breeding-places for Anophelines throughout the summer and autumn and the incidence of the disease increased considerably. In several areas extensive epidemics occurred; outbreaks of the disease, which was mostly of the benign tertian type, began towards the end of May and reached a maximum in July. *Anopheles sacharovi*, Favr (*elutus*, Edw.) was the prevalent mosquito, and the autumn epidemics of malignant tertian did not occur. Records show that in one locality the average catch rose from 10 individuals of *A. sacharovi* in the middle of April to 800 in the middle of June. During the latter month in 1928, the average catch was 110. Satisfactory control of the adults was obtained in certain villages by spraying with a pyrethrum-paraffin preparation. Some unusual facts with regard to the breeding of Anophelines were observed during the year under review. *A. sacharovi* was found breeding freely in puddles on the banks and dry beds of rivers where formerly *A. superpictus*, Grassi, had been observed; breeding was in progress at a high and even rate throughout May and June, and was still continuing in July. An unidentified Anopheline was taken in a trough, which was a customary breeding-place of *Culex* sp. The unusually cool temperature during the spring and early summer was favourable for the development of *A. sergenti*, Theo., and individuals were taken in various localities throughout the country during June and July. The incidence of *A. sacharovi* in various localities is discussed in detail.

Silt-pitting on Estates in Relation to Mosquito Breeding and Malaria.—*Malayan Agric. J.*, xviii, no. 8, pp. 376–377. Kuala Lumpur, August 1930.

In order to stop surface wash of water during heavy rainfall and induce rapid percolation through the soil, it is usual on Malayan rubber estates, especially in hilly situations, to make silt-pits, which hold accumulations of water for some time. These permit the breeding of Anophelines such as *Anopheles maculatus*, Theo., which

is a malaria carrier, particularly in places where other accumulations of water are dealt with by oiling. It is not therefore desirable, nor is it necessary, that these accumulations should remain for any length of time, and measures should be taken to accelerate drainage by a system of continuous trenches, using artificial stops of a pervious nature, such as rubble or brushwood, to prevent wash during heavy rain. Where the soil tends to be impermeable, it is impossible to prevent small puddles remaining at the bottom of drainage trenches, and in these cases oil should be applied by spraying or with a very small mop, once every two weeks, or the pits might be dusted with Paris green once every 5–7 days. In flat land, continuous trenches should be constructed without stops, and small depressions retaining water should be filled in with loose soil. Deep water drains are advisable, connected with the natural drainage system of the area and treated with larvicides. No accumulation of water should be allowed to lie long enough for Anopheline breeding within about half a mile of any dwelling.

Shannon (R. C.) & Seraphim Junior (J.). **Revisão do catalogo da fauna de Anophelinos no Brasil, com observações sobre algumas especies do grupo** *Nyssorhynchus* **encontradas na Bahia e Recife, consideradas de importancia como os mais provaveis vehiculadores de malaria nessa região.** [A Revision of the Catalogue of the Anopheline Fauna of Brazil, with Notes on some Species of the *Nyssorhynchus* Group found in Bahia and Recife, considered of Importance as the most probable Vectors of Malaria in that Region.]—*Arch. Hyg.*, iv, no. 2, pp. 79–96[1]. Rio de Janeiro, 1930. (With Summaries in English and French.)

This paper contains a short historical note on the Anophelines of Brazil, followed by a list of the 28 species, showing their synonymy, and a more detailed report on those of the *Nyssorhynchus* group, *Anopheles argyritarsis*, R.-D., *A. albitarsis*, Arrib., and *A. tarsimaculatus*, Goeldi, found in Bahia, than one already noticed [*R.A.E.*, B, xviii, 72]. These three species and *A.* (*N.*) *bachmanni*, Petrocchi, occur in Recife. The other Anophelines found in Bahia are probably not vectors of malaria, as they are less numerous and less closely associated with man. The breeding-places of the three species mentioned require special attention in springs and ditches near dwellings in the malarious areas. A long series of dissections should be made of the Anophelines in the malarious areas of Bahia in order to establish an infection index as a basis for measures against the breeding-places, and for *A. tarsimaculatus* this index should also be studied in winter when it is the predominant species.

de Mello (E. J.). **Medida do progresso e efficiencia dos serviços anti-larvarios nas campanhas contra a febre amarella.** [Estimates of the Progress and Efficiency of anti-larval Measures in Campaigns against Yellow Fever.]—*Arch. Hyg.*, iv, no. 2, pp. 207–214 [3], 2 figs. Rio de Janeiro, 1930. (With Summaries in English and French.)

The following are the author's recommendations for observations in connection with the control of the yellow fever mosquito [*Aëdes argenteus*, Poir.] in towns in Brazil: The use of mosquito indices and

of other indices is of value for measuring the progress and efficiency of anti-larval measures in campaigns against yellow fever. Since each of them has a different meaning, and also for the sake of comparison, at least the following proportions should be systematically computed: (1) the ratio of houses with breeding-places to all houses examined (*house index*); and (2) the ratio of breeding-places to the total number of houses visited (*density index*). As a complement to these indices, the ratio of breeding-places to the total number of receptacles (*deposit index*) may be ascertained with advantage. The ratio of receptacles containing living larvicidal fish to the total number capable of supporting fish life (*fish index*), which has been proposed by the author, has proved to be a useful measure of efficiency in supplying dwellings with fish. The regular observation of the various indices, which is greatly assisted by the graphic method, is capable of giving a better knowledge of the progress attained and of tendencies in the efficiency of the campaign.

Whitmore (E. R.). **The Place of Plasmoquin in Malaria Control.**—*18th Ann. Rep. Med. Dept. United Fruit Co. 1929*, pp. 30–37, 2 charts, 5 refs.

Whitmore (E. R.), Roberts (C. M.) & Janzen (W.). **The Action of Plasmoquin in rendering Subtertian Gametocytes non-infectious for Mosquitoes.**—*T.c.*, pp. 37–54. Boston, Mass. [1930.]

In order to obtain more information on the dosage of plasmochin necessary to render gametocytes of malaria non-infective to mosquitos, further experiments [*cf. R.A.E.*, B, xvii, 246] were undertaken in Honduras during 1929, a more detailed account on the work being given in the second paper than in the first.

After the asexual cycle of *Plasmodium falciparum* had been controlled by quinine and a single dose of 20 mgm. plasmochin (not less than 0·3 mgm. per kg. of body weight) had been administered, no oocysts were observed to develop in *Anopheles albimanus*, Wied., fed for 4–7 consecutive days on the patient. A dose of 10 mgm. (not more than 0·2 mgm. per kg. of body weight) was not sufficient to prevent the development of oocysts in *A. albimanus* fed for 3–6 consecutive days.

[**Observations on Malaria and its Control.**]—*18th Ann. Rep. Med. Dept. United Fruit Co. 1929*, pp. 65–69, 1 chart; pp. 70–71; pp. 74–79, 4 refs.; pp. 79–85, 1 chart; pp. 88–97. Boston, Mass. [1930.]

The first of this series of five papers, by W. H. W. Komp, deals mainly with the incidence of malaria in the Almirante Division, Panama. Of mosquitos caught in houses, 76 females of *Anopheles albimanus*, Wied., and 4 of *A. punctimacula*, D. & K., were dissected, but none was infected. In one locality where numerous engorged adults were observed, *A. albimanus* was found breeding in large numbers among mats of *Nitella* in shallow water in an old river bed. The fine silt on the banks of this river was found to be an excellent diluent for Paris green. A small stream was examined for mosquito breeding, but only a few larvae of *Anopheles* (*Chagasia*) *bathanus*, Dyar, were observed.

In the second paper, the same author deals mainly with the incidence of malaria in other districts. In a limited survey of mosquito breeding-places undertaken in the middle of the dry season, no large larvae or pupae were encountered (except in one small pool), showing that dusting with Paris green had been effectively carried out. Most of the larvae were those of *Anopheles pseudopunctipennis*, Theo., which is not usually regarded as an important vector of malaria, except in Argentina. No adults of *A. albimanus* were observed. Most of the transmission of malaria takes place after the beginning of the wet season, when *A. albimanus* breeds in the numerous pools in pastures in the vicinity of the camps. It is suggested that collections of adult mosquitos should be made at stated intervals, especially during the wet season, to supplement the larval index as a measure of the effectiveness of dusting operations.

In the third paper, P. S. Malaret describes the organisation of anti-larval control measures in the Preston Division, Cuba [*cf. R.A.E.*, B, xvii, 247], and from a comparison of data for the three years 1927–29 concludes that the number of breeding-places has been reduced. Judging from the topography and the usual conditions existing in this region, he believes that a material part of this reduction is due to the constant application of Paris green dust mixtures and not solely to the low rainfall experienced in 1929. This view is supported by the fact that the intensity of breeding has also diminished and that fourth instar larvae ready to pupate were rarely recorded, although they were numerous at the beginning of the campaign. Moreover, the decrease in the number of cases of malaria in the district where control measures have been in effect has been remarkable, whereas the surrounding localities continue to be heavily infected. One of the carriers used for Paris green was a mixture of lime and sawdust. The lime leaves a white film on the water, so that the thoroughness of the dusting can be checked by inspection.

In the fourth paper, J. R. Maltsberger discusses the problems encountered and the methods applied in an effort to reduce the incidence and severity of malaria during the pioneer development of a new banana plantation in Panama. The anti-larval control measures consist mainly in the application of Paris green and sawdust (1 : 100) or Diesel engine oil combined with kerosene. Two districts are in the process of being drained. Streams have been cleared and close supervision has been exercised over rain barrels and casual watering places during the dry season. In nineteen months the average rate of infection has fallen from 35·6 per cent. to 17·8.

In the fifth paper, E. I. Salisbury and J. A. Corrigan describe the topography and climatic conditions of Costa Rica, and discuss the measures taken for the control of malaria in this region. It is thought that an altitude up to 2,500 ft. has little or no bearing on the degree of breeding of Anopheline mosquitos. *Anopheles albimanus* is the predominating species. Paris green is used mixed with fine river silt (1 : 100) and is applied by hand or dust gun or, if the motor car used in connection with it is travelling along the railway, it is applied to borrow pits and railroad ditches by a mechanical blower attached to the rear of the car at either side. Insecticidal sprays are used in camps and cars where the adult Anopheline index is high. The costs of a general drainage scheme in this division would be prohibitive owing to the nature of the terrain. In general rainfall is heavy in November, December and January, larvae are washed away by floods and adults

are destroyed by wind and rain. During this time the malaria rate drops. This period is followed by a short dry season in which breeding is concentrated and malaria infections begin to occur. Later, daily moderate rainfall prevails, pastures are flooded, ditches are filled, and the rivers flow steadily but do not flood. Mosquito breeding spreads and becomes general, and the malaria incidence increases until flooding again occurs and the breeding-places are destroyed. Anti-larval measures should be carried out when the breeding areas are concentrated during the dry season.

HAYES (T. H.). **Report of Mosquito Survey in St. Croix.**—*U.S. Naval Med. Bull.*, xxviii, no. 1, pp. 194–222, 1 map. Washington, D.C., January 1930.

Up to 1926 malaria was extremely rare in St. Croix, but it became prevalent after the arrival of immigrants from Porto Rico in 1927. The survey, which is described in detail, showed that the amount of permanent fresh water and potential breeding areas for Anophelines is greater in St. Croix than had been believed. The actual breeding at all seasons is more than sufficient for the spread and constant increase of malaria. The habits and breeding-places of *Anopheles albimanus*, Wied., *A. grabhami*, Theo. (which was very rare), *Culex fatigans*, Wied. (*quinquefasciatus*, Say) and *Aëdes argenteus*, Poir. (*aegypti*, auct.) are discussed in detail. *C. fatigans* is almost certainly the vector of filariasis, which is prevalent on the Island. *Anopheles albimanus* breeds in any water-holding area, preferring cool, clean, very slowly moving water and pools of grassy environment and containing an abundance of *Spirogyra*. It also distinctly prefers the blood of animals, particularly cattle and horses, to that of man. The most effective natural enemy is the fish, *Lebistes reticulatus*, which was imported from Barbados in 1902. Other natural enemies and remedial measures that have been found effective in other countries and might prove applicable to St. Croix are recorded.

JACKSON (L. E.) & others. **Improved practical and economical Methods of Mosquito Control.**—*Amer. J. Publ. Hlth.*, xx, no. 6, pp. 628–632. Lancaster, Pa., June 1930.

This paper deals with the results obtained by J. M. Ginsburg on factors affecting the toxicity of oils to mosquito larvae [*R.A.E.*, B, xvii, 243], and by Matheson & Hinman in studying a newt [*Diemictylus viridescens*] that destroys the larvae [xvii, 242] and on the effect of *Chara fragilis* on mosquito development [xvi, 141 ; xvii, 214].

MIYAMOTO (S.). **Ueber die Vernichtung von Moskitos durch** *Pipistrellus abramus* **in der Nähe der Stadt Taihoku.** [The Destruction of Mosquitos by *P. abramus* in Taihoku.] [*In Japanese.*]—*Taiwan Igakkai Zasshi* [*J. Med. Ass. Formosa*], no. 301. April 1930. (With a Summary in German, p. 19.) (Abstract in *Trop. Dis. Bull.*, xxvii, no. 11, p. 903. London, November 1930.)

Mosquitos were found in the stomachs of 12 out of 45 bats, *Pipistrellus abramus*, examined in Formosa between August and December.

As an instance of the appetite of this bat, one individual was able to catch 1,527 mosquitos in 3 hours, and three others had the stomach more than half full of them.

Barbeau (L. G.). **Annual Report of the Bacteriological Laboratory for the Year 1928.**—*Ann. Rep. Med. Hlth. Dept. Mauritius 1928*, pp. 16–22. Mauritius, 1930.

Sheathed microfilariae of *Filaria bancrofti* and unsheathed embryos, apparently belonging to a different species, having been found on several occasions in blood films taken in the day time, experiments were carried out with two common day biting mosquitos in Mauritius, *Aëdes argenteus*, Poir. (*aegypti*, auct.) and *A. albopictus*, Skuse, and with *Culex fatigans*, Wied., which feeds at night. Fully formed filarial larvae were readily seen in the proboscis of *C. fatigans* after 15 days. The filarial larvae in both the species of *Aëdes* were in the thoracic muscles a few days after the infecting feed, but development was soon arrested and remains of larvae in various stages of degeneration were all that could be found after the 14th day. Though it appears that the latter species are not active carriers of filariasis in Mauritius, no clue has been obtained regarding the reversed periodicity and non-periodicity shown by the microfilariae.

Mail (G. A.). **Viability in Eggs of *Aëdes campestris* Dyar and Knab (Culicidae).**—*Science*, lxxii, no. 1859, p. 170. New York, N.Y., 15th August 1930.

Eggs of *Aëdes campestris*, D. & K., one of the dominant mosquitos in Montana, were stored in pond water in stoppered vials at a temperature of 0–10° C. [32–50° F.] for 20 months. The stoppers were then removed and the vials exposed to 22° C. [71·6° F.]. About 25 per cent. of the eggs hatched within 12 hours, and during the following 5 days several more gave rise to healthy larvae that duly matured. This remarkable viability of the eggs complicates the problem of control.

Dinger (J. E.), Schüffner (W. A. P.), Snijders (E. P.) & Swellengrebel (N. H.). **Untersuchungen über Gelbfieber in den Niederlanden.** [Investigations in Holland on Yellow Fever.] –*Zbl. Bakt.* (1 Orig.), cxviii, no. 1–2, pp. 6–12. Jena, 28th August 1930.

To estimate the danger of native monkeys serving as reservoirs of yellow fever if it were introduced into the Dutch East Indies, a study of their susceptibility is of importance [*R.A.E.*, B, xviii, 82]. Transmission experiments with *Macacus cynomolgus* showed that old monkeys from Java were much less liable to become infected than young ones, either from Java or born in Europe. Both monkeys and man are known to be less susceptible when young, so that this points to a certain degree of immunity acquired by the monkey. As yellow fever does not exist in the Dutch East Indies, the immunity must be due to an allied disease, such as dengue, benign forms of which are of widespread occurrence there. Experiments are being made to ascertain if the serum from convalescent cases of dengue from the Dutch East Indies can protect *M. rhesus* against yellow fever.

In other experiments with *Aëdes argenteus*, Poir. (*aegypti*, auct.), from Togo, transmission failed at such intervals as 20-30 days, but succeeded with 37, 61, and 100 days, thus indicating an abnormally long "extrinsic incubation" in the mosquito. It is suggested that this may be an effect of the winter season (November, December) comparable with the long latency in autumn of benign tertian malaria.

LAMBORN (W. A.). **The Medical Entomologist's Report for 1929.** — *Ann. Med. Rep. Nyasaland 1929*, pp. 38-41. Zomba, 1930.

The situation with regard to *Glossina morsitans*, Westw., in the Dowa and Fort Manning Districts of Nyasaland, and the further measures taken for its control in 1929 are reviewed. The possibility of the cyclical transmission of trypanosomiasis of animals by means of vectors other than *Glossina* was further studied [*cf. R.A.E.*, B, xviii, 45], but negative results were obtained with large numbers of *Ornithodorus* and *Cimex*, using a polymorphic strain of trypanosome. A list is given of the Tabanids collected, with notes on their seasonal incidence and on the remarkable pupal chambers of *Tabanus biguttatus*, Wied. [*cf.* xviii, 104].

An attempt was made to ascertain how the various species of mosquitos, particularly the Anophelines, that are found in the hill country during the wet season maintain themselves during the drought. In May, 22 females of *Anopheles gambiae*, Giles, 214 of *A. funestus*, Giles, and 6 of *A. rhodesiensis*, Theo., were caught in native huts, and larvae of other species that do not invade dwellings were taken in large numbers in breeding-places. In October and November (late dry season), neither adults nor immature forms were found. At the beginning of the rains the sylvan species were the first to reappear, and it was not until five weeks after the initial storm that the domestic species were again observed. The eggs of certain Culicines that breed in rot holes in trees are known to lie dormant in the absence of water and to hatch only when the holes are filled on the advent of the rainy season. Débris collected during the dry season from rot holes, hollows in the ground and rocks known to be breeding-places of mosquitos in the wet season, was therefore thrown into water, and shortly afterwards numbers of small larvae of *Aëdes* spp. were observed. On the day after the first storm of the rainy season, which occurred on 24th November, large numbers of larvae (including those of *Aëdes* (*Stegomyia*) *vittatus*, Big., an experimental vector of yellow fever) were found. Pupae were first seen on the 27th, and emergence of the adults began the next day. It is suggested that ova of certain species of Anophelines may undergo a similar period of aestivation for, four days after the storm, larvae of *Anopheles rhodesiensis* and *A. pretoriensis*, Theo., all of the same size and very near maturity, were found in a pool known to have been dry previously.

MACLEAN (G.). **Sleeping Sickness Measures in Tanganyika Territory.** — *Kenya & E. Afr. Med. J.*, vii, no. 5, pp. 120-126. Nairobi, August 1930.

Rhodesian sleeping sickness in Tanganyika Territory is associated with *Glossina morsitans*, Westw., and *G. swynnertoni*, Aust. Even if *G. pallidipes*, Aust., and *G. austeni*, Newst., should also prove to be vectors, they are unlikely to become of great importance, owing to their

limited distribution. In Mwanza and Tabora, nearly all the cattle country is potential forest and tsetse country, and conversely most of the tsetse areas are potential cattle and agricultural areas. In these and in some other Provinces, almost the sole factor determining bush and grazing land is agriculture. The method of agriculture is important, particularly at the edge of the forest, where any method that exhausts the soil encourages the return to bush.

The factors to be taken into consideration in the re-distribution of the population as a means of reducing the incidence of sleeping sickness are discussed. The methods adopted in the Territory to accomplish this consist largely in the concentration and consolidation of scattered populations in large communities either in the forest or on the borders of open country. The systems of agriculture introduced are described in detail. Whatever method is used, the complete treatment of all cases of sleeping sickness is aimed at, and the areas affected are always closed to labour recruiting for a period of years.

SWYNNERTON (C. F. M.) & PHILLIPS (J.). **Department of Tsetse Research, Tanganyika Territory. Annual Report on Research for the Year ended 31st December 1929.**—Med. 8vo. 20 pp. London, Cr. Agents Colon., 1930. Price 1*s.*

SWYNNERTON (C. F. M.). **Department of Tsetse Research, Tanganyika Territory. Annual Report on Experimental Reclamation for the Year ended 31st March 1930.**—Med. 8vo. 24 pp., 4 pls. London, Cr. Agents Colon., 1930. Price 1*s.* 6*d.*

In the first paper the progress made in the various investigations on the ecology of *Glossina morsitans*, Westw., in Tanganyika Territory [*cf. R.A.E.*, B, xviii, 61] is outlined.

In the second paper the work of the Reclamation Sub-Department [*cf.* xviii, 60] is reviewed, and the programme of future work and the objects for which it has been planned are explained. This sub-department has been divided into Administrative Reclamation, which deals with the application of certain methods, such as clearing, late grass-burning, settlement, etc., the value of which has been proved, and Experimental Reclamation, which is continued to test new methods.

MOSSOP (M. C.). **Tsetse Fly in South Africa.**—*Bull. S. Afr. Dept. Agric.*, no. 44, 25 pp., 1 pl., 2 pp. refs. Pretoria, 1928. [Recd. 1930.]

An account is given of the bionomics and control of tsetse-flies, with particular reference to *Glossina pallidipes*, Aust., and trypanosomiasis of cattle in Zululand, most of the information being taken from the literature [*cf. R.A.E.*, B, xvi, 129; xv, 88; etc.].

DUKE (H. L.). **The Discovery of *T. rhodesiense* in Man in the Uganda Protectorate.**—*Trans. R. Soc. Trop. Med. Hyg.*, xxiv, no. 2, pp. 201–218, 1 map, 1 chart, 9 refs. London, 8th August 1930.

After giving a brief account of the distribution of *Trypanosoma rhodesiense* in Africa, the author describes the discovery, made during a study of arsenic-resistant strains of *T. gambiense*, of a case of sleeping

sickness from the West Nile area of Uganda that was found to be due to *T. rhodesiense*. The possible value of arsenic-resistance in the detection of *T. rhodesiense* is discussed. The disease caused by this trypanosome is apparently always associated with the presence of game-tsetse (*Glossina morsitans*, Westw., or *G. swynnertoni*, Aust.), and the frequency of the disease in any area is roughly proportionate to the dependence of the fly on man for food. So far as could be ascertained, the single case recorded in the Belgian Congo [*R.A.E.*, B, xvii, 40] had visited no area where *G. morsitans* is known ; *G. palpalis*, R.-D., *G. pallidipes*, Aust., or one of the large forest species were the only species with which the patient could have come into contact, and none of these is suspected of harbouring *T. rhodesiense* in nature. Conditions in the West Nile area of Uganda are similar to those in the southern Sudan where *T. rhodesiense* also occurs [x, 234] ; there is a native population in contact with *G. morsitans* and *G. palpalis*, and *T. gambiense* has been known to exist for years. Further examination of arsenic-resistant cases from the West Nile area is being carried out.

The two main theories as to the origin and relationships of *T. rhodesiense* are that it is a variant of *T. brucei* that has overcome the normal disability of that species to use man as a host [xi, 63 ; xvii, 40] or that it is merely *T. gambiense* in a new and non-immune community [xvii, 39]. It is suggested that both these theories may be correct. By selection during exposure of the trypanosome to arsenical drugs, or by mutation, an arsenic-resistant *T. gambiense* may appear, and if at the same time its virulence increases, the essential ingredients of *T. rhodesiense* are obtained. If such a strain retained its characters when passed cyclically through tsetse-flies, it might become established locally as a focus of virulent human trypanosomiasis insusceptible to arsenical drugs. On the other hand the possibility of *T. brucei* becoming able to utilise man as a host is not yet excluded. *T. rhodesiense*, wherever it is found, seems to depend on man for its survival and spread. In all probability *T. gambiense* could not survive in nature in the absence of a fairly close contact between man and fly, but it has depended for ages on man as its principal mammalian host, whereas the epidemiology of *T. rhodesiense* indicates that from a biological point of view it is much less dependent on man than *T. gambiense*. The invariable association of its insect vector with game proves beyond reasonable doubt that *T. rhodesiense* must often be introduced by tsetse into mammals other than man in nature, and unpublished results of laboratory experiments have shown that even in domestic ruminants this trypanosome can survive and retain its transmissibility by *Glossina* for a month or two at least.

The author points out the importance of the question whether *T. rhodesiense* can re-infect man after being harboured by game, because, if it loses this power the converse view that "human strains" of *T. brucei* may develop in man in nature and that their survival, which is precarious, depends on passage from man to man, will be more readily acceptable. The view that game does not harbour the trypanosome in a form infective to man is supported by Dye's observations in Tanganyika Territory [xvi, 90]. If it can be proved that man can be exposed freely to fly in a previously infected area where the game has not been seriously disturbed, without contracting the disease, one of the following conclusions is possible : that the game suffices for the fly and man is not bitten ; that the disease in man is spread mainly or exclusively by direct transmission ; that

T. rhodesiense reverts very rapidly and easily to *T. brucei* in the absence of man to keep it up to standard ; or, supposing the disease in man to have originated from the introduction of a strain of *T. gambiense* from outside sources, that this *T. gambiense* also loses its ability to utilise man once it has become a parasite of game, or that it becomes "lost in the bush," for laboratory experiments have shown that *T. gambiense* introduced into ruminants, wild and domestic, can survive for at least a year in a form readily transmissible by *Glossina*.

DE ALMEIDA (C.) & REBELO (F.). **Os trabalhos das Missões do Sono estabelecidos nos distritos do Congo e Zaire em 1923.** [Work of the Sleeping-sickness Missions established in the Congo and Zaire Districts in 1923.]—*Rev. med. Angola*, 1927, no. 5, pp. 9–92. (Abstract in *Bull. Inst. Pasteur*, xxviii, no. 17, pp. 803–804. Paris, 15th September 1930.)

Active work against sleeping sickness has been carried on since 1924 in Angola, where only the northern districts, comprising about one-third of the country (Zaire, Congo, Cuanza and Lunda), are affected. The land consists of treeless plains with occasional clumps of vegetation and the degree of humidity is not high. It is therefore surprising to find *Glossina palpalis*, R.-D., and also *G. fusca*, Wlk., and *G. longipalpis*, Wied., far from any water supply. They are carried there by buffalo, which are their principal source of food. A. Damas Mora, who writes a preface to this paper, believes that these animals are also the chief factor in maintaining endemicity of the trypanosome infection, but the senior author considers that neither this nor any other large mammal of the region plays this part. He found, from September 1923 to July 1925, an average percentage of 11·8 out of a human population of 20,000 in one district to be infected with trypanosomes. He is opposed to the destruction of big game, which is necessary as food for the natives, and to systematic clearing of the scrub, unless it is close to dwellings or river crossings, the removal of villages to healthy positions being preferable, together with the isolation and treatment of infected persons. Statistics for northern Angola show also the frequent occurrence of malaria, filariasis and relapsing fever carried by *Ornithodorus*.

SINTON (J. A.). **The Female of** *Phlebotomus nicnic* **Banks, 1919.**—*Ind. J. Med. Res.*, xviii, no. 1, pp. 165–169, 1 pl., 7 refs. Calcutta, July 1930.

A summary is given of the original descriptions of the male and female of *Phlebotomus nicnic*, Banks, and the female is re-described in detail. It is considered to be a distinct species.

SINTON (J. A.). **Some new Species and Records of** *Phlebotomus* **from Africa.**—*Ind. J. Med. Res.*, xviii, no. 1, pp. 171–193, 5 pls., 2 pp. refs. Calcutta, July 1930.

A summary of the chief records of the distribution of the African species of *Phlebotomus* is compiled from the literature. *P. babu*, Ann., is recorded from Mauritius. *P. symesi*, sp. n., and *P. yusafi*, sp. n.,

are described from Kenya and *P. freetownensis*, sp. n., from Sierra Leone. Brief notes are also given on what may prove to be a new species from Kenya of which only males were obtained.

IYENGAR (M. O. T.). **Jungle in Relation to Malaria in Bengal.**—*Ind. J. Med. Res.*, xviii, no. 1, pp. 259–266, 1 ref. Calcutta, July 1930.

In view of the fact that a high incidence of malaria in certain localities in India is frequently attributed to the proximity of jungle, the author records his observations on different jungle areas in Bengal. Jungle is defined as uninhabited land covered by forest trees, shrubs or brushwood, tall and thick enough to prevent the exposure of the land surface to sunlight to any appreciable degree. Jungles of the hill regions were investigated on three occasions. Breeding of mosquitos is slight and confined to the rainy season. Four Anophelines occur, *Anopheles gigas* var. *simlensis*, James & List., *A. aitkeni*, James, *A. lindesayi*, Giles, and *A. annandalei*, Prashad, none of which has been known to transmit malaria. Owing to the elevation, however, little or no malaria occurs in these regions.

The sub-montane zone is very malarious and Anophelines are numerous, but those found breeding in the jungles were *A. barbirostris*, Wulp, *A. aitkeni*, *A. insulaeflorum*, Swellgr., *A. leucosphyrus*, Dön., *A. lindesayi*, and (in tree holes in one district) *A. annandalei*, species that are not usually, if ever, concerned in the transmission of malaria. Outside the jungle the Anopheline fauna changes and includes many well-known vectors of malaria. The age of the jungle does not appear to affect the extent to which Anophelines breed.

The Sunderbans is a maze of islands cut up by a network of tidal channels. Part of this area has been cleared and is under rice cultivation, and part is still covered by a dense jungle of mangrove. The area is subject to tidal flooding except where it is protected by embankments. Within the jungle are shallow basins that hold saline water and are not affected by tides. These jungle swamps were investigated, as well as the numerous small streams within the forest, but no Anophelines were found. Moreover, no adults were found in the huts of forest workmen or in the small floating flats used by the staff of the forest department. These results are in striking contrast to those obtained in the cultivated areas, where intense breeding occurs in the collections of brackish water that are prevented from draining into the watercourses by the embankments protecting the land against tidal flooding. A considerable amount of malaria exists in the cleared areas, where *A. ludlowi*, Theo., a malaria carrier, is one of the commonest species.

Thus it appears that jungles are not connected with the incidence of malaria and actually form a protection against the breeding of harmful species of Anophelines. Shade does not appear to be the only factor concerned in the inhibition of the breeding of species that occur in open country, for in some areas in the interior of the forest where water is exposed to sunlight and conditions are apparently favourable for breeding, no open country species were observed. Once human habitations are made on the cleared land, malaria vectors begin to breed immediately.

KORKE (V. T.). **Observations on the Correlation between the Incidence of filarial Infection in the Human Host and in the Insect Carrier in Relation to Terrain. Part V. Observations on the Characters of filarial endemic Areas in Bihar and Orissa. Part VI.**—*Ind. J. Med. Res.*, xviii, no. 1, pp. 319–331, 1 map, 8 refs. ; pp. 333–336, 7 refs. Calcutta, July 1930.

For the purpose of investigating the relation of filarial incidence and terrain, the Province of Bihar and Orissa was divided into four belts comprising the plains north and south of the Ganges, respectively, which are slightly above sea level, the montane, sub-montane and forest areas, which form the bulk of the Province and include arable land in the extensive alluvial tracts, and the coastal belt in the south-east corner. Rice is the chief crop. A list is given of the prevalent mosquitos and their distribution in the various belts. A detailed survey of the four areas shows that the incidence of infection of man with *Filaria bancrofti* varies with the terrain, being lowest in the sub-montane arable areas, higher in the plains of the Ganges and highest in the sea-coast belt. Dissections of 874 female Anophelines gave negative results, whereas 10 per cent. of the 2,132 female Culicines examined were infected, *Culex fatigans*, Wied., being the only species in which developmental forms were found. There is no direct correlation between the degree of infection in man and in the mosquito, although such a correlation is indicated in urban areas. Infection in *C. fatigans* appears to be higher in June and July than in the other months and also in individuals collected inside houses than in those caught out of doors. Areas in which rice cultivation is extensive seem to be the endemic centres. In the sub-montane belt and the Ganges plains, the percentage of infection is distinctly higher in the towns than in the villages, but in the coastal belt the urban and village areas are equally affected, and the evidence points to the fact that the physical characters of the area and the type of village are such as greatly to favour infection once it is introduced.

WEBSTER (W. J.) & CHITRE (G. D.). **Observations on Rat-fleas and the Transmission of Plague. Part II.**—*Ind. J. Med. Res.*, xviii, no. 1, pp. 337–345, 6 refs. Calcutta, July 1930.

In connection with the study of the flea factor in plague epidemiology [*R.A.E.*, B, xviii, 138], a rat-flea survey of the city of Bombay was carried out from March 1929 to February 1930.

The following is taken from the authors' summary. *Xenopsylla cheopis*, Roths., and *X. astia*, Roths., are both widely distributed, the former being 5 to 12 times more numerous on *Mus* (*Rattus*) *rattus*. *X. brasiliensis*, Baker, is practically confined to the most rural area of the six that were studied. No marked seasonal variation has been demonstrated. Of the 4,459 fleas identified, 69·6 per cent. were *X. cheopis*, 27·0 *X. astia*, 3·3 *X. brasiliensis* and 0·1 *Ctenocephalides* (*Ctenocephalus*). The gross flea index was found to be 4·4 for *M. rattus*, 6·9 for *M.* (*R.*) *norvegicus* and 9·6 for *Gunomys*. The three species of *Xenopsylla* have been found on each of these hosts. The *cheopis* index is slightly higher for *M. norvegicus* than for *M. rattus*, and *Gunomys* harbours fewer fleas of this species than either. The *astia* index of *M. norvegicus* is 5 times and of *Gunomys* 14 times greater

than that of *M. rattus*. The approximate percentage of females in the three species of fleas was 40 in *X. cheopis*, 60 in *X. astia*, and 35 in *X. brasiliensis*.

LLOYD (R. B.) & NAPIER (L. E.). **The Blood-meal of Sandflies investigated by means of Precipitin Antisera.**—*Ind. J. Med. Res.*, xviii, no. 1, pp. 347–359, 3 graphs, 1 ref. Calcutta, July 1930.

To supplement earlier experiments on the blood meals of *Phlebotomus* [*R.A.E.*, B, xiii, 124], further observations were made in Bengal over a period of two years, using a much larger number of sandflies collected at different seasons from different localities. The gut contents were tested for human and bovine blood. The following is taken from the authors' summary of results and conclusions, the sandflies referred to being *Phlebotomus argentipes*, Ann. & Brun., except where otherwise stated.

The gut contents of sandflies that have at some time during their life fed on human blood gave a positive reaction with anti-human precipitating serum in 88 per cent. of the cases tested. Within the time limits examined, it appears to make no difference whether the meal is recent or not; in two sandflies a positive reaction was obtained eight days after the feed on man, a remarkable result in view of the amount of digestion that must have occurred.

P. argentipes and *P. papatasii*, Scop., feed almost exclusively on the blood of cattle or man, but *P. babu*, Ann. (*minutus*, auct.) may also feed on the blood of other animals. *P. argentipes* feeds less persistently on human blood than *P. babu*, and *P. papatasii* less readily than either.

There are marked variations in the feeding habits of *P. argentipes*. The percentage of feeds on human blood increases in the hot weather (April to June) and again even more markedly in the autumn. The latter rise can be explained by the fact that the rainy season (July to September), which precedes it, provides the most suitable conditions for ensuring longevity of the sandfly. No special differences were found in the feeding habits of the sandflies in different localities. The previous observation that when the blood of cattle and man are both available *P. argentipes* feeds more readily on cattle [*loc. cit.*] was confirmed. The percentage of sandflies containing human blood appeared to vary in inverse ratio to the distance of human sleeping quarters from the cattle shed where they were caught.

Little evidence was obtained in favour of the sandfly theory of kala-azar transmission except that in nature *P. argentipes* is a persistent feeder on human blood, and that the percentage of sandflies containing human blood reaches its highest point at the time of the year when they are most numerous, *viz.*, in the autumn. These facts are in keeping with the rise in the incidence of kala-azar in the cold season.

PARROT (L.), DONATIEN (A.) & LESTOQUARD (F.). **Sur le développement du parasite de la leishmaniose canine viscérale chez *Phlebotomus major* var. *perniciosus* Newstead.**—*Bull. Soc. Path. exot.*, xxiii, no. 7, pp. 724–726, 2 refs. Paris, 1930.

In experiments in Algeria, *Phlebotomus perniciosus*, Newst., was fed on a dog infected with visceral leishmaniasis and showing secondary lesions in the skin. Of 53 of these sandflies dissected 1–3 days later, 4 contained flagellates in the stomach that showed all the morphological

characters of culture forms of the parasite of canine visceral leishmaniasis. They did not occur in any other part of the digestive tract. It is known that *P. perniciosus* feeds readily on both man and dogs, so that this observation supports the possibility that the same parasite causes both infantile kala-azar and canine visceral leishmaniasis and may be transmissible from dogs to man.

[Vasil'ev] Wassilieff (A.). **Recherches sur l'épidémiologie pesteuse au Sénégal en 1929. Les réservoirs de virus.**—*Bull. Soc. Path. exot.*, xxiii, no. 7, pp. 737–747, 3 refs. Paris, July 1930.

Continuing his observations on plague in Senegal [*R.A.E.*, B, xviii, 249], the author examined during 10 months about 10,000 rats, of which only 6 were found infected with plague. From this and from the investigations of other workers, it does not seem that the rat is an essential reservoir of plague, unless it harbours the virus in an invisible form, as the outbreak of plague in 1929 occurred without any previous epizootic among rats. On the other hand, fleas taken from native dwellings in the bush during the plague epidemic of 1929 were infected. Throughout the whole survey, *Xenopsylla cheopis*, Roths., was found breeding in enormous numbers on rats and in native dwellings, and its presence in the huts strongly indicates that it constantly attacks man, and the fact that it is a proved carrier of plague renders it far more dangerous than *Pulex irritans*, L. Experiments in Russia with the fleas of *Citellus* have shown that these can live for 13 months and at the end of that time can cause a fresh outbreak of plague. The author has found *X. cheopis* alive in burrows in native dwellings that had been deserted by rats five months previously [*cf. loc. cit.*] and although their infectivity could not be tested, the fact that positive results were obtained with fleas taken in a plague-infected house is significant. Further research on the spot is necessary, however, to verify the hypothesis of this flea being a reservoir of plague.

Department of Entomology.—*Ann. Rep. S. Afr. Inst. Med. Res. 1929*, pp. 29–31. Johannesburg, 1930.

The following fleas have been shown to be capable of transmitting plague from rodent to rodent in South Africa: *Dinopsyllus lypusus*, J. & R., *Chiastopsylla rossi*, Wtrst., *Xenopsylla brasiliensis*, Baker, *X. cheopis*, Roths., *X. eridos*, Roths., *X. hirsuta*, Ing., *Ceratophyllus fasciatus*, Bosc, *Ctenocephalides* (*Ctenocephalus*) *canis*, Curt., and *Leptopsylla segnis*, Schönh. (*musculi*, Düg.).

Demaria (A.) & Gallinato (V.). **Pulgas de las ratas de la costa Sur-Occidental de Sud-América. Nota preliminar para el estudio de la distribución y epidemiología de la peste en Chile.** [Rat Fleas of the South-west Coast of South America. Preliminary Note on the Distribution and Epidemiology of Plague in Chile.] —*Rev. Inst. bact. Chile*, i, no. 1, pp. 35–39, 4 figs. Santiago de Chile, 1929.

In Santiago in the summers of 1928 and 1929, the average number of fleas per rat was 12·6. Of these 35·5 per cent. were *Xenopsylla cheopis*, Roths., the others being Sarcopsyllids, *Leptopsylla segnis*, Schönh.

(*musculi*, Dug.), *Pulex irritans*, L., and *Ctenocephalides* (*Ctenocephalus*) *canis*, Curt. Of 893 fleas from 91 rats in Valparaiso in the autumn of 1929, 46·6 per cent. were *Ceratophyllus fasciatus*, Bosc, 42·9 *L. segnis*, 6·4 *P. irritans*, 3·1 Sarcopsyllids and 1 *X. cheopis*. On one rat captured at Almeda there were 80 fleas, of which 60 were *X. cheopis*.

[Tikhomirova (M. M.) & Nikanorov (S. M.).] **Тихомирова (М. М.) и Никаноров (С. М.). Ticks as Plague Carriers.** [*In Russian.*]—*Rev. Microbiol.*, ix, no. 1, pp. 60–61, 1 ref. Saratov, 1930. (With a Summary in English, p. 129.)

Eight individuals of *Rhipicephalus schulzei*, Olenev, were taken in the steppe in western Kazakstan in May 1929 on a ground squirrel (*Citellus pygmaeus*) that was dying of plague, and three of *Ixodes hexagonus*, Leach (*autumnalis*, Leach.) were found in the Russian Far East in July of the same year on a dying tarabagan, *Marmota* (*Arctomys*) *bobak*, that had been artificially infected with plague in the laboratory. In each case *Bacillus pestis* occurred in cultures from the crushed ticks, and in the bodies of guineapigs infected by an injection of the tick-emulsion. It is probable that ticks can preserve the bacillus longer than fleas, and as they readily change their hosts, they may be of considerable importance in the spread of plague.

[Golov (D. A.) & Knyazevskiĭ (A. N.).] **Голов (Д. А.) и Князевский (А. Н.). Sur le rôle des ectoparasites (puces et tiques) du nid vide des spermophiles** (*Citellus pygmaeus*) **dans l'épidémiologie de la peste.** [*In Russian.*]—*Rev. Microbiol.*, ix, no. 1, pp. 62–67. Saratov, 1930. (With a Summary in French, pp. 130–132.)

An account is given of observations carried out in July 1929 on plague in ground squirrels (*Citellus pygmaeus*) in western Kazakstan, where a heavy epizootic occurred and spread as far as the river Ural. Infected fleas were found on the ground squirrels and in their nests. *Rhipicephalus schulzei*, Olenev, occurred on many of the ground squirrels, but injection of an emulsion of the ticks did not produce plague in laboratory animals. Infected individuals of *R. schulzei*, which had probably harboured the virus for many weeks, were, however, found in abandoned nests ; injection of an emulsion of these ticks produced plague in a mouse. As *R. schulzei* has been found on a polecat (*Putorius eversmanni*), sheep, goats, dogs and camels, it is suggested that infected ticks might easily pass to domestic animals grazing in areas where an epizootic among ground squirrels occurs, and be carried by them to new places when they move from one pasture to another. They might also pass to man and infect him, at any rate by being crushed as they were removed. The possibility of hereditary transmission of the infection in ticks should be studied.

Hoffmann (C. C.). **Los Argasidos de Mexico.** [The Argasids of Mexico.]—*An. Inst. Biol. Univ. Nac. Mexico*, i, no. 2, pp. 135–164, 28 figs. Mexico, 1930.

The Argasid ticks occurring in Mexico, a key to which is given, are *Argas persicus*, Oken, *Ornithodorus megnini*, Dugès, *O. turicata*, Dugès,

O. talaje, Guér., and *O. coriaceus*, Koch. Each of these species is described, and an account is given of its bionomics, with brief notes on control. *A. persicus* occurs in all the hot, dry regions, attacking man and other mammals rarely and only when its natural hosts, domestic and wild birds, are absent. Feeding occurs every 15–25 days. There is no proof that it transmits *Spirochaeta venezuelensis* (*neotropicalis*), the causal organism of South American relapsing fever, and in the author's experiments it did not transmit *S. duttoni*. Although spirochaetosis of fowls, caused by *S. gallinarum*, has not been recorded in Mexico, it probably exists there. *O. megnini* occurs in the arid and semi-arid districts of the central plateau, the south, and the Pacific Coast. At altitudes of about 8,000 ft., the eggs apparently develop only in the hot months. It infests the ears of man without doing much harm, though in cattle this infestation results in deafness and is believed sometimes to end fatally. *O. turicata* inhabits approximately the same regions as *O. megnini*, but does not commonly occur above about 6,000 ft. It chiefly infests pigs, sometimes causing death, but may occur on rodents. Man is occasionally attacked, and, very exceptionally, domestic animals other than pigs. In man the bite causes severe irritation that may last for months. In Mexico no cases of relapsing fever have been recorded from the areas of distribution of *O. turicata*, and *O. talaje* appears to be the sole vector of *Spirochaeta venezuelensis*. This tick occurs in the hot zone, and its distribution corresponds with that of the disease (Vera Cruz and Yucatan). *O. coriaceus* is found on small rodents, etc., in the hot and temperate zones of Mexico. It also infests cattle and other domestic animals, and occasionally man, but its bites only cause local irritation.

Faust (E. C.) & Maxwell (T. A.). **The Finding of the Larvae of the Chigo, *Tunga penetrans*, in Scrapings from Human Skin. Report of a Case.**—*Arch. Derm. Syph.*, xxii, no. 1, pp. 94–97, 6 figs., 3 refs. Vienna, July 1930. (Abstract in *Trop. Dis. Bull.*, xxvii, no. 11, p. 920. London, November 1930.)

In scrapings of the skin of the pubic region of a resident of New Orleans who had recently been infested with *Tunga penetrans*, L., from a cargo of hemp imported from Yucatan, were found hundreds of larvae of this flea. The larvae were in an advanced stage, many of them thriving and some full of blood.

Hoffmann (C. C.). **Ueber *Onchocerca* im Süden von Mexiko und die Weiterentwicklung ihrer Mikrofilarien in *Eusimulium mooseri*.** [On *Onchocerca* in the South of Mexico and the further Development of its Microfilariae in *Simulium mooseri*.]—*Arch. Schiffs- u. Tropenhyg.*, xxxiv, no. 9, pp. 461–472, 6 figs., 13 refs. Leipzig, September 1930.

This information on *Onchocerca caecutiens* in the Chiapas coffee zone of Mexico, where the microfilariae have been found in *Simulium* (*Eusimilium*) *mooseri*, Dampf, and *S.* (*E.*) *ochraceum*, Wlk., and *S. avidum*, Hoffmann [*R.A.E.*, B, xviii, 216] also occurs, is substantially the same as in a paper already noticed [xviii, 213], but more details are given regarding the disease in man.

CORRADINI (G.). **Die Malaria in Rovigno.**—*Arch. Schiffs- u. Tropenhyg.*, xxxiv, no. 9, pp. 487–504. Leipzig, September 1930.

The author discusses a variety of problems relating to malaria, as a result of observations since 1895 at Rovigno (Istria). He concludes that cases of benign tertian malaria in spring (March–May) are relapses from the preceding year, apparently new infections being first cases developing after a long latency. Transmission in spring by hibernating infected mosquitos appears to be impossible, for oocysts and sporozoites die if the mosquito is long exposed to a temperature below 18° C. [64·4° F.], and all attempts to find them have failed except in the Roman Campagna. The theory of acquisition of infection in winter implies sufficient warmth for the development of the parasite in the mosquito, and the dwellings are not sufficiently heated for this to occur.

STEVENSON (L.). **The Warble Flies.**—*Bull. Ontario Dept. Agric.*, no. 350, 11 pp., 7 figs., 4 refs. [Toronto] January 1930.

A popular account is given of the bionomics of *Hypoderma lineatum*, Vill., and *H. bovis*, DeG., attacking cattle in Ontario, and formulae for various dressings for their control are included.

GAUT (R. C.) & WALTON (C. L.). **Ox Warble Fly. Report on the Demonstration and Experiments carried out in Worcestershire in 1928 and 1929.**—Med. 8vo, 26 pp. Worcester, Worces. C.C. Agric. Educ. Sub-Comm., October 1929. [Recd. 1930.]

Experiments in which a number of washes and ointments were tested against *Hypoderma lineatum*, Vill., and *H. bovis*, DeG., in cattle are described. It was found that a derris-soap wash [*cf. R.A.E.*, B, xviii, 204] gave 100 per cent. control. It should be applied first between 25th and 28th March, and again on three occasions at intervals of not more than four weeks. The experiments show that the average total cost of the four applications is not more than 1*d.* per head of cattle for material.

CAMERON (A. E.). **Oviposition of** *Haematopota pluvialis* **Linné.**—*Nature*, cxxvi, no. 3181, pp. 601–602, 1 fig. London, 18th October 1930.

The literature on the eggs of European Tabanids is briefly reviewed. Up to the present no eggs of any species of *Haematopota* have been found, but females of *H. pluvialis*, L., captured near Edinburgh in July 1930 and fed on the hand or forearm of man or on the ear of a rabbit laid eggs in the laboratory. One female laid 75 eggs on the side of a glass jar 10 days after engorging; another female deposited a mass of 125 eggs on a flowering head of perennial rye grass. In each case a layer of moist sand was placed on the bottom of the jar, into which were stuck the stems and leaves of grasses, and the escape of the fly was prevented by plugging the mouth with a wad of cotton wool. Pairing probably occurs soon after the adults emerge from the pupae. The eggs and the process of oviposition are described. Each egg is coated with cement, and it adheres firmly to the surface on which it is laid and to the other eggs. Hatching occurred in 10 days with a mean daily temperature in the laboratory of 60° F.

HOLDAWAY (F. G.). **Field Populations and natural Control of *Lucilia sericata*.**—*Nature*, cxxvi, no. 3182, pp. 648–649, 1 fig. London, 25th October 1930.

When investigating the biological agencies that play a part in regulating the numbers of *Lucilia sericata*, Mg. (sheep blow-fly) at Toulouse, it was found necessary to undertake a quantitative study of the insect population of carrion from the beginning of putrefaction to the disappearance of all consumable parts. It was found that any significant effect that parasites and predators can have on the ultimate numbers of the fly surviving takes place after the bulk of the population has been destroyed by other means, of which the competition between the larvae of various species of *Lucilia*, *Calliphora* and *Sarcophaga*, and *Chrysomyia albiceps*, Wied., which destroy each other, is the most important. The magnitude of the competition and the fauna concerned differ according to the season, weather and type of bait used. *Lucilia sericata* is the first member of an ecological succession which comprises chiefly Diptera, Staphylinids, Silphids, Histerids, Hymenoptera, Dermestids and Carabids. *L. sericata* plays the part of a coloniser; oviposition in fresh meat begins a few minutes after exposure and in entire animals a few hours after death. Of the subsequent species of Diptera, larvae of Sarcophagids in meat baits and those of *Chrysomyia* in baits of whole animals cause the greatest reduction in population, and both are most abundant during the summer. In 1929 in a bait of half a sheep's head laid on a piece of mutton, the initial population of 50,000 individuals of *L. sericata* was reduced in 24 hours to 48,562 and only 231 flies eventually emerged. In 1930 under slightly hotter conditions using a rabbit as bait, a population of approximately 60,350 *L. sericata* and 2,850 *L. caesar* was finally reduced to 30, the final population of *Chrysomyia*, that had in this case caused the reduction due in the first case to Sarcophagid larvae, being 2,611.

WARDLE (R. A.). **Significant Variables in the Blowfly Environment.**—*Ann. Appl. Biol.*, xvii, no. 3, pp. 554–574, 1 fig., 18 refs. London, August 1930.

The following are some of the author's conclusions, based on experiments and calculations described in detail: The resistance of the environment to the potential abundance of the pre-imaginal stages of *Lucilia sericata*, Mg., is most pronounced during the first larval stage and the prepupal stage.

The major significant variables in the environment limiting the potential abundance, in order of importance, include values during the season of adult activity of atmospheric and soil temperatures outside an optimum range lying between 30 and 37° C. [86–98·6° F.]; values of relative atmospheric humidity outside an optimum range of 90–100 per cent.; and values of soil moisture content outside an optimum range of 40–60 per cent. These variables increase the duration values of the life-cycle stages, limit the number of annual generations, and limit the potential population density at the commencement of hibernation or aestivation. Values during the season of hibernation or aestivation of soil temperature outside an optimum range of

10–30° C. [50–86° F.] and of soil moisture content outside a range of 40–60 per cent. influence the rate of mortality and the duration value of the hibernating or aestivating prepupal stage. Unfavourable ratios between the female population density of each generation and the available mass of oviposition media induces competition between ovipositing females, restricts the potential egg production, and brings about an unfavourable ratio between the number of eggs deposited per unit mass of medium and the number of larvae that can secure positions within the medium. Variations in the physico-chemical constitutions of the larval food medium induced by variations of atmospheric humidity, and by air movements, fungi and bacteria curtail the larval stage and induce a high mortality rate among succeeding prepupae and a low proportion of females in the succeeding imaginal phase. Of biotic factors, the most important are parasites and predators of the second larval stage.

DINULESCU (G.). **Sur la biologie des oestres du cheval.**—*C.R. Acad. Sci. Fr.*, cxci, no. 12, pp. 499–501, 3 refs. Paris, 1930.

An account is given of studies of the larval behaviour of *Gastrophilus intestinalis*, DeG., *G. haemorrhoidalis*, L., and *G. inermis*, Br., in guineapigs, dogs and horses.

The primary larvae of the first two flies, after hatching, prefer the mucous membrane of the tongue of the host, while those of *G. inermis* choose that of the lateral walls of the mouth. At this stage the larvae are furnished with a cephalopharyngeal armature that enables them to make galleries through the subepithelial layers of the mucous membrane, in which they make their way to the back of the mouth. Arrived in the pharynx after 22 days, they undergo their first moult. The larvae of the second instar, which lasts 45–60 days, attach themselves to the mucous membrane of the pharynx, fixing themselves to the floor, especially under the epiglottis. The cephalopharyngeal apparatus is changed after the first moult and allows them to implant themselves deeply in the tissues, to suck the blood upon which they feed. They remain there only temporarily, leaving after a very short time to take up their position in the digestive organs—*G. intestinalis* in the stomach, *G. haemorrhoidalis* in the stomach and rectum, and *G. inermis* in the rectum. Those in the stomach attach themselves to the walls, in the case of the horse on the mucous membrane of the cardiac division close to the line separating it from the pyloric division, in the dog towards the cardiac orifice.

The third instar larvae have a cephalopharyngeal armature similar to that of the second instar. They attempt to cluster in masses to avoid being carried away by the food, but if they are few, they wander along the surface of the stomach, until they can attach themselves definitely. In this case they are more dangerous to the horse, on account of the numerous wounds they cause. The larvae of *G. intestinalis* and *G. inermis* remain within the host until the commencement of the pupal stage, but those of *G. haemorrhoidalis* leave the host before completing the third larval instar and attach themselves around the anus for 4–5 days, when they fall and bury themselves in the ground to pupate. The changes that occur in the respiratory apparatus during the three larval instars are described.

Yearbook of Agriculture, 1930.—Med. 8vo, vi+1080 pp., 219 figs. Washington, D.C., U.S. Dept. Agric., 1930. Price $1.50.

Papers dealing with entomological subjects include: Screw-worm Losses to Livestock Industry can be Reduced, by F. C. Bishopp (pp. 469–472), in which it is stated that the losses from the screw-worm fly [*Cochliomyia macellaria*, F.], mainly occurring in the stock-producing States of the south-west, are estimated at from £800,000 to £2,000,000 annually, and the methods of burning carcases and trapping the flies are described; and Tick Eradication is making rapid Gain in Florida, by T. W. Cole (pp. 509–512), which reviews the progress of work against the Texas fever tick [*Boophilus annulatus*, Say].

Papers noticed by Title only.

Felt (E. P.). **A popular Guide to the Study of Insects.**—*N.Y. St. Mus. Handb.*, 6, 147 pp., 62 figs. Albany, N.Y., 1929. [Recd. 1930.]

Reichenow (E.) & Wülker (G.). **Leitfaden zur Untersuchung der Tierischen Parasiten des Menschen und der Haustiere. (Zugleich Neuauflage des gleichnamigen Leitfadens von Braun und Lüke.)** [Textbook on the Investigation of Animal Parasites of Man and domestic Animals (including a brief Chapter on Arthropods).]—8vo, vii+235 pp., 104 figs. Leipzig, C. Kabitzsch, 1929. Price £1. 2*s*.

N[atvig] (L. R.). *Anopheles maculipennis* **Meig.** [occurring in Norway about 30 miles north of Oslo].—*Norsk ent. Tidsskr.*, ii, pt. 6, p. 360. Oslo, 1930.

[Dubovs'kiĭ (N.).] **Дубовський (Н.). Notes on bloodsucking Culicidae in the District of Lugansk** [including a Description of the Male of *Aëdes* (*Ochlerotatus*) *behningi*, Martini]. [*In Ukrainian.*]—*Sanit.-ent. Byull.*, i, no. 3, pp. 12–16, 9 refs. Kharkov, 1930.

[Leĭzerman (L. I.).] **Лейзерман (Л. И.). Bibliographical Index of the Russian Literature on the Family Culicidae up to 1927.** [To be continued.] [*In Russian.*]—*Sanit.-ent. Byull.*, i, no. 3, pp. 29–32. Kharkov, 1930.

Falleroni (D.). **Costruzioni rurali in zone malariche.** [Rural Building in malarial Zones. (The Planning of Dwellings and Animal Quarters in Relation to Anophelines.)]—Med. 8vo, 24 pp., 5 pls., Rome, 1930. [*Cf. R.A.E.*, B, xviii, 55.]

Marshall (J. F.) & Staley (J.). **An English Record of** *Culex* (*Neoculex*) *apicalis* **Adams (Diptera, Culicidae).**—*Entomologist*, lxiii, no. 810, pp. 259–260, 1 fig. London, November 1930.

Tulloch (G. S.). **A Key to the biting Mosquitoes of New England.** [Adults and Larvae, with Notes on Bionomics.]—*Psyche*, xxxvii, no. 3, pp. 234–244, 2 figs. Boston, Mass., September 1930.

Shannon (R. C.). **O apparecimento de uma especie africana de** *Anopheles* **no Brasil.** [The Occurrence of an African Species of *Anopheles* [*gambiae*, Giles] in Brazil.]—*Brasil-Medico*, xliv, no. 19, pp. 515–516. Rio de Janeiro, 10th May 1930. [*Cf. R.A.E.*, B, xviii, 150.]

D'Anfreville de la Salle [L.]. **Un procédé récent de lutte anti-paludéenne.** [The Use of Fish against Mosquito Larvae in Morocco.]—*Rev. Méd. Hyg. trop.*, xxii, no. 4, pp. 193–196, 1 ref. Paris, 1930. [*Cf. R.A.E.*, B, xviii, 146.]

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